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THE FEEDING OF DAIRY COWS.

SUPPLEMENTARY FODDER CROPS AND MAXIMUM RETURNS IN NEW ZEALAND DAIRYING.

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RELATION OF FOOD TO PRODUCTION.

FARMING consists, generally speaking, in the production of crops that may either in themselves represent marketable commodities or may be capable of being converted into such through the agency of live-stock. So far as the actual conversion of crops into live-stock products is concerned there is a very great difference in the degrees of economy with which this is effected by various classes of live-stock. In other words, certain classes of stock are more efficient in converting crops into animal products than others. This is expressed in the following comparative statement showing the quantity of live-stock products produced by various classes of animals from every 100 lb. of digestible food consumed :—

One hundred pounds of digestible food consumed produces—150 lb. milk at 1s. per gallon, 15s. ; 5 lb. cheese at 1s. per pound, 15s. ; 6½ lb. butter at 2s. per pound, 13s. ; 24 lb. pork at 6d. per pound, 12s. ; 12 lb. lamb at 6d. per pound, 6s. ; 8 lb. mutton at 5d. per pound, 3s. 4d. ; 9 lb. beef at 4d. per pound, 3s.

These figures, although only an approximation based on researches of foreign investigators, nevertheless clearly show the vast differences that exist in the economy with which different farm-animals convert crops into marketable commodities. It can be readily seen that the dairy cow and pig are by far the most efficient in this respect of any of our live-stock. So far as the pig is concerned it is shown to stand far above both sheep and cattle in the economical conversion of crops

into meat; but this is hardly correct from a practical standpoint, as the pig can make full use of only certain feeds in meat-production, and these feeds are mainly those of a finer, more concentrated type, and are generally dearer than those which can be readily used in the production of meat by sheep or cattle. In other words, the pig, not being a ruminant, is unable satisfactorily to convert coarse feeds such as grass and forage crops into meat, as can be done by sheep and cattle. Nevertheless, the efficient manner in which the pig will convert starchy foods, such as grain, into pork, especially when such foods are combined with such milk-products as skim-milk and whey, indicates fairly the important position the pig should occupy on the dairy-farm, and also the possibility of securing very high returns from the growing on the farm of concentrate crops such as cereals, peas, or beans.

This growing of special concentrate feeds so as to secure the utmost possible return from milk by-products in the shape of pork should become a feature of New Zealand dairy-farm management, especially where the per-acre value of land is not extremely high. Denmark is perhaps the most outstanding example of a country where the dairy cow and pig are the standard farm-animals, a condition due to a clear recognition of the more efficient and economical manner in which these animals can convert crops into valuable saleable commodities as compared with any other class of live-stock. It is this efficiency of the dairy cow, especially in its ability to digest coarse feeds such as grass and forage crops, that must make dairying the paramount industry on all land in New Zealand suited for the purpose. The fact that the dairy cow is able, from a given weight of feed, to produce a greater value of saleable product than any other animal means that crops fed to cows are of greater value than when fed to any other class of stock. It is for this reason that suitable land is more valuable when devoted to dairying than when used in any other phase of live-stock production.

The future progress of dairying in New Zealand lies in the adoption of methods that will lead to the production of butterfat at the cheapest possible rate; and, in general, it can be said that in dairying methods which increase the butterfat-production per acre decrease the cost of butterfat per pound. Dairying, as practised in New Zealand, is capable of being put on a much better economic position by careful attention to two points, both intimately concerned with decreased cost in the production of butterfat—namely, herd-improvement, and the adequate feeding of dairy cows so that their maximum milk-yielding capacity may be attained. These may be regarded as self-evident facts, but the low average butterfat yield of our herds—less than 170 lb. per cow—clearly indicates that neither of these considerations is sufficiently realized by the majority of our dairy-farmers.

Herd-improvement, by means of testing, elimination of low producers, and breeding from only well-constitutioned high producers mated to pedigree bulls of proved milking-strains, is naturally a matter of time, and improvement can only be secured gradually. On the other hand, the adequate feeding of dairy cows so as to enable them to produce to the utmost of their capacity is a matter capable of almost immediate adjustment. In consequence, it may be stated that in the adequate feeding of cows lies the greatest means of advancement available at the present time to the New Zealand dairy-farmer. It is not too much to say that a very large proportion of our dairy cows are not fed sufficiently during the year to enable them to yield to their maximum

capacity, and I have no hesitation in asserting that if all dairy-farmers had sufficient feed available to enable maximum production to be realized the average yield per cow would rise in a single year to well over 200 lb. This would represent an increase of over 13,000 tons of butterfat, or nearly £2,500,000, reckoning butterfat at 1s. 8d. per pound. This increase could be secured by growing, roughly, 1,000,000 tons of grass (or grass-equivalent) more than is being produced at the present time. In other words, butterfat to the value of £2 10s. would be secured from each ton of extra feed so produced. The economy of providing an abundance of feed to keep cows at their maximum production is so obvious that it is hard to realize that an underfed cow should be permitted on any dairy farm.

In the feeding of dairy cows, and for that matter of all animals, a portion of the food consumed is for the bodily upkeep of the animal, while the remainder is available for production. That portion devoted to the bodily requirement has been termed the "maintenance requirement," and represents the feed necessary to keep the animal at an even weight. That portion used for production—in the case of the dairy cow mainly of milk—is termed the "production requirement." The heavier the cow the greater will be the maintenance requirement, but I shall here deal with cows as averaging about 1,000 lb. in weight. Many Jerseys, of course, will be well below this weight, while the heavier breeds, such as Friesians and Shorthorns, will go well above it. From numerous definite experiments it has been shown that the maintenance requirement of cows of such a weight roughly represents a daily consumption of approximately 60 lb. of ordinary pasture-grass; or, in other words, about 10 tons of grass, or grass-equivalent, is required for the annual maintenance of a mature cow. For production, when maintenance requirements are satisfied, it requires about 1 ton of grass or its equivalent to produce 30 lb. of butterfat. Thus for the production of, say, 240 to 250 lb. of butterfat per cow 10 tons are required for maintenance and 8 tons for production, or 18 tons in all.

It will be seen that the great drain in feeding dairy cows is the maintenance feed-requirement, which exceeds that required for production where this is under 300 lb. per cow. The great object in the economical production of milk is that as large a percentage as possible of the food consumed should be available for production. Every ton used for maintenance brings no return to the dairy-farmer, but, on the average, every ton used for production turns out 30 lb. of butterfat. The maintenance requirement can never be reduced so far as the individual cows are concerned, but so far as the total food consumed is concerned the percentage devoted to maintenance is brought to a minimum by feeding the cows to the utmost of their producing-capacity. Any feeding below the full capacity of the animal increases the percentage devoted to maintenance, and is therefore unsound. This is where the great value of really high-yielding cows comes in. Take, for instance, the case of two cows each with a 200 lb. butterfat capacity, and one cow with a 400 lb. capacity. The feed consumed by the two lower-yielding cows would be 20 tons for maintenance and a little over 13 tons for production, a total of 33 tons of grass. The 400 lb. cow would require 10 tons for maintenance and 13 tons for production, or a total of 23 tons. Thus in one instance 400 lb. of butterfat would be produced from 23 tons of feed, while with the lower-yielding cows it would take 10 tons more to secure the same amount of butterfat.

This well illustrates the fact that the higher the percentage of the total feed consumed for production the higher will be the actual monetary value of all the feed consumed. In the case of the 200 lb. cow each ton of feed produces 12 lb. of butterfat, and in the case of the high producer 18 lb. of butterfat. In one case 1 ton brings in £1 and in the other £1 10s., with butterfat at 1s. 8d. per pound. This economizing of feed through using animals of high production can, of course, only be attained when such animals are available, and this will come about gradually by herd-improvement. However, in many cases much the same principle, which has as its basis the increasing of the percentage of food available for production by full feeding, can be put into operation by merely eliminating the lowest producers in a herd and feeding the remainder to their full capacity. Take, for instance, a herd of 100 cows yielding 24,000 lb. of butterfat. The feed consumed would be 1,000 tons for maintenance and 800 tons for production. Reduce the herd by 10 cows and we get 900 tons for maintenance and 900 tons for production, or 27,000 lb. of butterfat with the same feed that in the case of 100 cows gave only 24,000 lb. Numerous instances are on record where reduction in numbers has led to an increased butterfat return per acre, and there is no doubt that the very great immediate effects in yield that follow culling are to a certain degree due to the better feeding of the remainder. Thus in dairying one of the most important facts to remember is that dairying-land should never be overstocked; in fact, what may appear to be understocking will almost invariably result in a distinct increase in butterfat-production per acre.

SEASONAL FEED-REQUIREMENT OF DAIRY COWS.

In general, under average New Zealand conditions, for approximately three months of the year the daily feed-requirement does not exceed the maintenance requirement—that is, during the period the cow is drying off and is dry. During this term 60 lb. of grass or grass-equivalent per day will suffice. It often happens, however, that a cow finishes her season in poor condition, especially if of a pronounced dairy type, and requires to put on considerable weight before her next calving, in addition to which extra feed is required to make provision for the development of her yet unborn calf. Very often the adequate feeding of dry cows is much neglected, and this has a very potent bearing on the low average milk-yield in the Dominion. The idea apparently is that under-feeding the cows during their dry period will reduce the amount devoted to maintenance; but such system in no way accomplishes this end, tending rather to very seriously reduce the butterfat yield in the following season through a large portion of the spring feed being used to replace the weight lost in the winter. It is therefore advisable that all dairy cows should commence their season in really good condition, especially as during the early months of lactation many of them will produce more milk than can be formed from the feed they consume owing to their ability to "milk off," as it is termed, any superfluous fat formed during the dry period.

Cows are generally dry (winter milking is not now being taken into consideration) from about the middle of May to the middle of August, in many districts a period of very low grass-production. During these three months 3 tons of grass or grass-equivalent is really not too much for each cow. So far as the lactation period is concerned I here divide

it into two parts—namely, from the middle of August to the end of December, and from the beginning of January to the middle of May—and have called the first the spring period and the second the summer period. Roughly, two-thirds of the milk should be produced during the spring period and one-third during the summer period. Taking cows yielding an average of a little more than 6,000 lb. of 4-per-cent. milk, we thus have 160 lb. of butterfat produced by the New Year and 90 lb. after that period. During the first period nearly 4 tons of grass will be required for maintenance and a little over 5 tons for production, while in the second period nearly 4 tons will be required for maintenance and 3 tons for production. The seasonal feed-requirement for a 250-lb.-butterfat cow may be summarized as follows: Middle of May to middle of August, 3 tons grass—roughly 20 per cent. of total food; middle of August to end December, 9 tons grass—roughly 50 per cent. of total food; beginning of January to middle of May, 6 tons grass—roughly 30 per cent. of total food.

COMPARATIVE FEEDING-VALUE OF VARIOUS CROPS.

In the discussion of the comparative efficiency of various farm-animals in producing marketable products reference was made to the digestible matter consumed and not to the total feed consumed. All feeding-stuffs consist of water, and of solids termed the "dry matter." The percentage of dry matter in feeding-materials varies from about 90 per cent. of the total weight in the case of grain to less than 10 per cent. in the case of soft turnips, so that the dry matter consumed per 100 lb. of the food eaten varies from about 8 lb. to 90 lb. according to the class of food. Further, only a portion of the dry matter consumed is of a digestible nature, the remainder being voided by the animal in the shape of excreta. Again, the percentage of dry matter that is digestible varies very greatly, being highest in the case of the dry matter of grain and root crops and lowest in the case of rough fibrous forages.

I do not wish here to enter into a discussion on the digestible dry matter of crops, such as the protein, starch, sugar, fat, and fibre, and their relative importance, but it is advisable to deal in as understandable a way as possible with the comparative value of different crops from the nutritive standpoint. So far as the farmer is concerned, the simplest and easiest method to adopt is that which has been worked out in Denmark, known as the Danish feed-unit system, which is sufficiently accurate for all practical purposes. Under this system the nutritive value of a pound of mixed grain, such as wheat, barley, peas, &c., is calculated as being equivalent to one feed-unit. The number of pounds of any other feeding-stuff which will equal in feeding-value 1 lb. of grain is likewise considered to equal one feed-unit. Thus, for instance, it has been shown that 2 lb. of lucerne hay or 12 lb. of soft-fleshed turnips are each equal in feeding-value to 1 lb. of grain, and therefore each of these represents one feed-unit. The majority of our main feeds have been carefully investigated, and the Danish system enables us to readily determine the comparative nutritive value of most of the crops with which the New Zealand dairy-farmer is concerned. The Danish feed-unit very nearly corresponds with 1 lb. (Danish) of digestible dry matter, but, as the British pound is about 10 per cent. less than the Danish pound, a British pound of grain

contains only a little less than nine-tenths of a Danish pound of digestible matter. Thus in an English ton of grain there are approximately two thousand feed-units.

Applying the Danish system to our main dairying-crops we find that 1 ton of grain is equal to 2 tons of good lucerne hay, 2½ tons of mixed grass and clover hay, 2½ tons of good cereal and tares hay, 3 tons of poor grass hay, 5 tons of lucerne ensilage, 6 tons of grass or maize ensilage, 7 tons of green lucerne, 7½ tons of good mixed green grass and clover, 8 tons of green cereals, 9 tons of carrots, 9 tons of rape, 10 tons of swedes, 11 tons of hard turnips, 11 tons of mangolds, or 12 tons of soft turnips respectively.

On these figures, allowing the Danish pound as 10 per cent. greater than the English one, we get the following number of feed-units from 1 ton of each of the crops specified: 1 ton of grain is equal to 2,000 feed-units; 1 ton of lucerne hay to 1,000; 1 ton grass and clover hay to 800; 1 ton cereal and tares hay to 800; 1 ton poor grass hay to 670; 1 ton lucerne ensilage to 400; 1 ton grass or maize ensilage to 330; 1 ton green lucerne to 290; 1 ton good pasture-grass to 275; 1 ton young green cereals to 230; 1 ton carrots to 220; 1 ton rape to 220; 1 ton swedes to 200; 1 ton hard turnips to 180; 1 ton mangolds to 180; and 1 ton soft turnips to 160 feed-units.

GROSS EARNING-POWER OF VARIOUS CROPS.

From the figures quoted it can be seen that 1 ton of good pasture-grass contains about 275 feed-units, and as it has been shown that 18 tons of such feed is necessary for the production of 250 lb. of butterfat a total of 5,000 feed-units per year is arrived at. Thus each pound of butterfat produced requires 20 feed-units, and with butterfat at 1s. 8d. per pound each feed-unit produces 1d. worth of fat. When maintenance requirements are satisfied 8 feed-units devoted solely to production produce 1 lb. of butterfat.

The comparative gross earning-power of our various crops can now be set down on a monetary basis:—

Crop.	Yield per Acre.	Feed-units per Acre.	Gross Return per Acre at 1d. per Feed-unit.
	Tons.		£ s. d. £ s. d.
Grain	¾ to 1½	1,500 to 3,000	6 5 0 to 12 10 0
Lucerne hay	3 to 6	3,000 to 6,000	12 10 0 to 25 0 0
Good meadow hay	1½ to 3	1,200 to 2,400	5 0 0 to 10 0 0
Cereal and tares hay	2 to 4	1,600 to 3,200	6 13 4 to 13 6 8
Lucerne ensilage	7 to 14	2,800 to 5,600	11 13 4 to 23 6 8
Maize ensilage	10 to 20	3,300 to 6,600	13 15 0 to 27 10 0
Green lucerne	10½ to 21	3,100 to 6,200	12 18 4 to 25 16 8
Good pasture	8 to 16	2,200 to 4,400	9 3 4 to 18 6 8
Cereals, green	6 to 12	1,400 to 2,800	5 16 8 to 11 13 4
Maize	15 to 30	3,500 to 7,000	14 11 8 to 29 3 4
Millet	8 to 16	1,800 to 3,600	7 10 0 to 15 0 0
Sudan grass	7 to 14	1,500 to 3,000	6 5 0 to 12 10 0
Carrots	15 to 30	3,300 to 6,600	13 15 0 to 27 10 0
Rape	8 to 16	1,800 to 3,600	7 10 0 to 15 0 0
Swedes	25 to 50	5,000 to 10,000	20 16 8 to 41 13 4
Hard turnips	25 to 50	4,500 to 9,000	18 15 0 to 37 10 0
Mangolds	35 to 70	6,300 to 12,600	26 5 0 to 52 10 0
Soft turnips	25 to 50	4,000 to 8,000	16 13 4 to 33 6 8

How to cater for our cows' requirements may now be considered. The great dairying-crop in New Zealand is, of course, grass, and more reliance is here placed on grass than in any other country in the world. But much as I appreciate the fact that New Zealand possesses dairying-pastures unexcelled in any other part of the world, due largely to our climate, one cannot help realizing that our farmers demand too much of them, to the detriment of the dairying industry in general. Of course, it is well understood that the grass crop, so far as feeding-value is concerned, is by far the cheapest crop that can be grown, and for this reason the growing of special crops to supplement grass is often said to be unprofitable.

This is perhaps true under certain conditions of meat and wool production, but so far as dairying is concerned the growing of special crops to supplement grass is not only absolutely necessary but highly remunerative. It has been shown that 20 per cent. of the annual volume of feed is required during the dry period of the cow, 50 per cent. during the first period of lactation, and 30 per cent. during the second period of lactation. No grassland in New Zealand produces feed in this ratio, and the proper feeding of dairy cows in this country cannot be carried out unless suitable food is available in some such proportion. Considering ordinary pasture land, and taking a case where the annual production of grass per acre runs to about 10 tons per year, one might think that the production from 2 acres was amply sufficient to provide all feed-requirements of a cow of 240–300 lb. butterfat production. Ordinary dairying grassland, however, produces well over half its annual growth in the months of October, November, and December, as is exemplified by the hay crops of 1½ to 2 tons that can be produced by shutting up land for eight to ten weeks of this period. This means that between 5 and 7 tons of the 10-ton production is produced in this limited time. Quite a fair estimate of much dairying grassland shows it to produce 70 per cent. of its total feed during the period August to December, 20 per cent. in January to May, and 10 per cent. in May to August; while the feed-requirements of dairy cattle are approximately 50 per cent. in August to December, 30 per cent. in January to May, and 20 per cent. in May to August. It is thus seen that there is generally an excess of feed available during the August–December period, while at no other period is grassland production adequate. Even during this favourable period growth is not evenly distributed, as in August and part of September the yield of grassland is nearly always low, necessitating supplementary feeding. A certain improvement is obtained by making hay from a portion of the surplus August–December production and setting it aside for the winter, but this in no way eases up the January–May period, when it is apparent that, except perhaps in isolated cases, specially grown feeds are essential. What sometimes happens is that the dairy-farmer who has virtually sufficient cows to make full use of the August–December production, runs on little more than maintenance requirements during the January–May period, with consequent great loss in milk-production, and carries through the winter on an insufficient ration, bringing his cows into profit again in poor condition.

There is, of course, nothing to recommend such a system, as the quantity of food consumed for maintenance becomes far too high in proportion to that consumed for production. The whole object of dairy-farming is to have as high a percentage as possible of the food

consumed devoted to production. As already stated, the food consumed for maintenance brings in no profit to the dairyman, but, with fat at 1s. 8d. per pound, every ton used in production when maintenance is satisfied brings in a return of £2 10s. Again, and this is of immense importance, there is the fact that during the lactation period lack of sufficient food to keep the animal at its maximum production causes a rapid diminution of the milk-flow, and when once this has occurred it is extremely difficult to bring it back even when food again becomes abundant. It is thus clear that grassland alone will only support the maximum production of cows during a part of the August–December period, and even methods that lead to improvement in the production of pastures will not alter this fact, though they will, of course, increase the total production per year, which is a matter of great importance.

I do not think that most dairy-farmers properly realize what tremendous losses occur in the dairying industry through insufficient provision of supplementary feed, and, on the other hand, what large profits are realizable from crops grown for that purpose. Taking a definite example, suppose that in the month of February a herd of thirty cows shows a drop in yield per cow of 5 lb. of milk a day over what should be the normal decrease during that month, this represents a loss during the month of 4,200 lb. of milk, or 168 lb. of butterfat (calculated on 4-per-cent. milk). It has been shown that when maintenance requirements are satisfied 8 feed-units are sufficient to produce 1 lb. of butterfat, so that had 1,400 additional feed-units been available this loss need not have occurred. The requirements could have been furnished by feeding 600 lb. of soft turnips per day (20 lb. to each cow), which would have meant a saving of 6 lb. of butterfat, or 10s. per day. This represents a production value of over £1 17s. per ton for the turnips, so that a 40-ton crop of soft turnips is capable of bringing in a gross return of over £70 per acre. In other words, every additional feed-unit consumed by dairy cows when the ordinary grassland is failing to keep them to their maximum capacity brings in 2½d. worth of butterfat.

It may be well to enumerate the value per ton in this respect of certain of our standard crops, reckoning butterfat at 1s. 8d. per pound, thus: 1 ton of green lucerne, with 290 feed-units, will produce £3 worth of butterfat; 1 ton of soft turnips, with 160 feed-units, will produce £1 17s. 6d. worth of butterfat; 1 ton of ensilage, with 330 feed-units, will produce £3 10s. worth of butterfat; 1 ton of mixed green fodder and vetches, with 270 feed-units, will produce £2 10s. worth of butterfat. These figures should dissipate any idea that special-crop growing to keep up the maximum production of dairy cows when the grassland begins to fail does not pay, and at the same time show that such crops enable a full production value to be secured from all grassland, which is clearly impossible when sufficient supplementary feed is not grown.

MAIN SUPPLEMENTARY FEEDS FOR DAIRY COWS.

The main supplementary dairy-cow feeds can be conveniently divided into the following classes: Hay, ensilage, roots, green forages, and grain. In many cases the same crop can be utilized in a variety of ways, such as for soiling, silage, hay, &c., and certain crops are superior to others in this respect. I propose here to review briefly the main crops that come within the scope of the foregoing enumeration.

Hay.

The main hays are permanent-pasture hay, temporary-pasture hay, lucerne hay, cereal and tares hay, and certain special-crop hays such as Sudan grass. In New Zealand by far the most important hay is that derived from permanent pasture, and about 100,000 acres of grassland is annually shut up for its production. This gives about 1 acre of hay for every ten cows in the Dominion, or between 3 cwt. and 4 cwt. of hay per cow. This is clearly inadequate, and even in good dairying districts the position is bad in this respect, not more than 4 cwt. of hay being available for each cow. An adequate hay provision is essential, both for the proper winter feeding of cows and to supplement the very watery grass feed available in the early spring. In my opinion half a ton of hay per cow is little enough, and unless plenty of roots or other supplementary feed is also available it is not sufficient. The statistics therefore indicate that our present hay-production must be doubled or even trebled if dairying is to be put on a proper economical basis.

Personally, I am greatly against hay-production on long-rotation and permanent grassland, holding that the practice is extremely detrimental to the maintenance of such grassland. Paspalum is an exception, and the haying of paspalum grassland is a sound practice. Temporary pastures of Italian rye-grass and clovers are excellent for hay, and unless lucerne can be successfully grown temporary pastures for hay-production should be a feature of every dairy farm. Wherever lucerne can be successfully and easily grown it should provide all the hay required, but where it is not successful special hay crops, especially cereals and tares, should be grown to a far greater extent than they are at present. Cereals and tares for hay-production may be either autumn- or spring-sown—when autumn-sown they are often extremely useful for feeding off in the winter, while a portion of the spring-sown crop frequently becomes of great value for soiling when dry conditions obtain before the soft-turnip crop is ready. It can therefore be laid down that in districts where lucerne is not successful cereals and tares should be largely grown.

Ensilage.

Until recently, in common with many of our farmers, I held the opinion that ensilage as a staple supplementary feed for dairy cows in New Zealand was too expensive to produce, but on this point I now have quite an open mind. The economics of ensilage production and utilization here require to be carefully studied before any definite decision can be given. In America ensilage is the most important of all supplementary feeds for dairy cows, but, of course, conditions there are vastly different from those of New Zealand. What does impress one with ensilage in America, however, is the fact that it is rapidly taking the place of green-cut forage (soiling) crops. The position that the American farmer adopts is that ensilage is always ready just when it is wanted, whereas, no matter how skilful a farmer may be, his provision for forage crops for soiling during the summer may come to nought through unfavourable weather conditions. His soiling-crop may not be ready just when required, or if ready there may be an abundance of grass and it is not really wanted.

My own opinion is that if ensilage finally does become important in dairy-farm management here it will be as a summer supplementary feed and not as a winter feed. In New Zealand hay and roots must

always remain the staple winter feeds—hay and swedes for preference—and where swedes cannot be grown mangolds or carrots will have to take their place. In many districts, however, the successful growing of soft turnips for summer feed, especially when quite small dairy farms become general, may not be permanently feasible owing to disease, and unless lucerne can be grown it is more than possible that ensilage will take their place rather than special green forages such as millets, vetches, Sudan grass, and the like. The superior yield possible from maize is quite likely to make maize ensilage of importance. Green maize is not satisfactory as a feed, owing to the fact that it is not always ready when wanted, while its small percentage of nitrogenous material renders it too unbalanced a food for milk-production. On the other hand, maize ensilage supplemented with crushed grain would prove admirable for feeding when pastures dry up in the summer. Where lucerne is grown the first cut of the season, owing to weather conditions, must generally be made into ensilage, and in this connection the mixing of a straw stack with the lucerne is an admirable practice. Lucerne ensilage may be used either for winter or summer feeding, but would be generally used in the winter, as the summer production of lucerne provides an abundance of soiling-material for summer use.

Roots.

Roots should occupy an important position in the supplementary feeding of dairy cows; and swedes, mangolds, carrots, and soft turnips are all valuable, especially from the point of view that they produce more feed-units per acre than any of our other crops. Where swedes can be successfully grown they should, with hay, provide the main winter feed; apart from their high yield the fact that they can be grazed off renders them the cheapest crop that can be grown. They cannot be used, however, when the cows come into milk, and as the yield from pastures is often low at that time mangolds or carrots must then take their place in combination with hay-feeding. In districts where swedes cannot be grown mangolds or carrots must take their place for both winter and spring feeding, but as they are both comparatively dear and troublesome to produce and make use of, dairy-farmers who cannot grow swedes may find that increasing their supply of hay is more feasible than any extensive growing of mangolds or carrots. For summer supplementary feeding the soft turnip, to my mind, stands out supreme, and fortunate indeed is the New Zealand dairy-farmer that this crop can be so easily and cheaply grown in many districts. As already mentioned, it is probable that disease may sooner or later limit soft-turnip growing in many districts, but, provided they can be successfully produced, soft turnips must become the most important of all summer supplementary feeds for dairy cows.

In the feeding of soft turnips to milking-cows several points are of importance. Firstly, the crop must never be fed off on the ground, as can be done with swedes when feeding dry cows; secondly, each cow must not be fed with more than 40 lb. to 60 lb. of soft turnips per day, and feeding must take place immediately after milking; and, thirdly, it is advisable to supplement soft-turnip feeding with some green forage such as lucerne, vetches, millet, or the like. If these precautions are taken the danger of milk-tainting is negligible, as has been abundantly proved in Taranaki, where the soft turnip is the standard

summer supplementary feed. The fact that with a judicious selection of varieties a continuous supply of mature roots can be secured from the middle of January onwards is of especial significance in estimating the value of soft turnips.

Green Forages.

With the exception of lucerne, which can if necessary supply the whole of the extra summer requirement, I am not greatly in favour of green-cut forage crops, mainly from the point of view that the feed-unit return per acre is often small. During recent years Japanese millet has become very popular, partly because it may, if necessary, be grazed, and partly because it does fairly well on ground insufficiently cultivated for the maximum production of root crops. On farms where grassland completely fails during the summer green-cut forages, and especially forages that can be grazed if expedient, are often desired, while in North Auckland special paspalum paddocks for summer feeding are probably a sounder proposition than are many green-cut forages, or any attempt to produce grazable forages. In certain districts where paspalum will finally be the dominant grassland, special summer provision of extra feed will not be required, and instead of the August–December period being that in which grassland alone will be sufficient to enable maximum production to be realized, it will rather be the January–May period, when more than sufficient grass will be available. I foresee that for dairy-farmers in North Auckland the production of supplementary feed will be very largely concerned with adequate provision for the spring period of lactation, and for this purpose hay and roots should well meet the case.

Autumn-sown forages such as oats, barley, and the like, although useful under certain conditions for winter and early spring feeding, cannot compare in economy of production with root crops, and unless the ground otherwise would remain idle I do not advocate any extensive adoption of such types of cropping.

Grain.

Supplementary grain-feeding of dairy cows is little adopted in New Zealand, but I am strongly in favour of the growing of a small quantity of certain concentrates, such as oats, barley, peas, or beans, for feeding during the first month or so after the cows come into milk. Such feed provision, especially of the last two crops, is probably sounder than buying bran, a concentrate that is popular with a good many dairy-farmers.

CONCLUSION.

In conclusion I would emphasize the opinion that the time for relying so much on pasture in New Zealand has gone by, and that the really adequate feeding of dairy cows can only be secured by a thorough recognition of this fact by our dairy-farmers. We should by all means improve as far as practicable the production from grassland; but no such methods will enable the farmer to secure the maximum return from his herd. This can be done only by adequately supplementing the feed from pastures by means of specially grown fodder crops. My endeavour has been to show that the feeding of dairy cows to the limit of their production is economically sound.

COMMERCIAL POTATO-GROWING.

(Continued.)

H. E. McGOWAN, Willowbridge, South Canterbury.

CHOICE OF VARIETIES.

AFTER selecting the ground for the potato crop the variety considered best suited for the class of soil should be chosen. Potatoes may be divided into several groups or tribes as follows: (1) The white kidney tribe—Ashleaf Kidney, Lapstone, Royal, &c.; (2) the white oval—Up-to-Date, Bruce, Dalmeny Beauty, &c.; (3) the white round—Irish White Rock, Northern Star, Gamekeeper, Arran Chief, &c.; (4) the pink kidney—Robin Adair, Lady Fife, &c.; (5) the pink round—Irish Red Rock, American Flourball, &c.; (6) the blue round or oval—Blue Derwent, Ireland's Farewell, &c.; (7) the blue and white—Maori Chief, Circular Head, Commonwealth, &c.; (8) the rough deep-eyed—White Elephant, Acme, Victor Rose, &c. These tribes could be divided into classes and the qualities of each class given, but that would make this article too lengthy, and only some of the well-known varieties will be dealt with.

For light sandy or shingly soil I would suggest Arran Chief, Early Puritan, Robin Adair, or Up-to-Date. For medium soil the same varieties as suggested for light soil may be selected, also Lapstone Kidney, Bruce, Dalmeny Beauty, Commonwealth, Victor Rose, and many others. Maori Chief, Gamekeeper, Northern Star, and Irish White and Red Rocks flourish in a good rich moist soil, being gross feeders and responding well under suitable conditions. Very few varieties like the cold clay ironstone class of soil, but it will be found that White Elephant and Victor Rose will do fairly well in it if planted early. Gamekeeper, Northern Star, and Maori Chief should not be planted on light soil, otherwise a large number of useless small potatoes strung together with roots will be produced.

When deciding which variety to plant it must be taken into consideration whether Irish blight is usually prevalent in the district. If it is prevalent a variety which is a good blight-resister should be selected. Further, the marketable value of the variety must be taken into consideration. Coloured varieties are not so much favoured as they were previously. This has been caused through some growers producing a certain red potato which is objectionable for the table, as after being boiled it turns an unsightly dark colour. The only reason why these growers produce this potato is because it is a very heavy cropper (they always grow another variety for their own use). It is most unfortunate that this one red variety has spoiled the whole New Zealand market for coloured potatoes. To the consumer one red variety is the same as another, but some of our red-skinned varieties are the best-quality table potatoes grown.

PLANTING.

Care in this branch of potato-culture is often much neglected by growers, although it may be regarded as coming next to selection in importance. The days of planting the seed in any sort of way and securing a heavy crop are past. The soil in those good old times was practically virgin—rich in humus, potash, &c. Now, after continual cropping, these constituents are deficient, all kinds of weeds are present to contend with, and it is only by proper rotation, careful cultivation, and proper planting that one can hope to get a good yield.

It is impossible to give a definite date for planting; what would suit Auckland would not suit Canterbury, and what would suit North Canterbury would not do for South Canterbury, and so on. I am, however, a firm believer in early planting, and always try to get my own crop planted early in September, preferring to risk a frost nipping the first plants rather than plant late. By planting early there is less

PLANTING POTATOES WITH THE MOULD-PLOUGH AND BY HAND.

risk of blight and of the crop being affected by drought. Moreover, one is able to dig earlier, thus catching the early market, when better prices may be expected. Further, through early digging one is able to get the land ploughed and an early autumn crop of wheat sown. It is also a great advantage to have the crop stored or sold before the frosts begin.

A personal experience showing the benefit of early planting may be given. The first year that Irish blight occurred badly in New Zealand I had planted my crop in August. Our usual planting-period in those days was October, and my neighbours had doubts as to my sanity. August happened to be a very fine month, and the potatoes went in in good order. Towards the end of September and in October we had very heavy rains which kept the general planting very late—in fact, my potatoes were up when my neighbours were planting theirs. My

crop yielded 15 tons per acre, and sold off the fork at £10 per ton. The blight appeared as my crop was ripening and very few tubers were affected, whereas most of the crops in the district were caught while very green and were devastated.

Machine Planting and Hand Planting.—Willowbridge is one of the largest potato-growing districts in the Dominion. The soil being of a rich sandy loam lends itself specially to potato-culture, and crop areas range from 5 acres up to 100 and 150 acres. Therefore practically all the crops here are planted by the potato-planting machine. I am not prepared to say whether hand planting or machine planting gives the better results, as so much depends upon the condition of the soil and the way the planting is done. The following, however, is the result of one trial which will assist readers to form their own judgment. When I

PLANTING POTATOES WITH A MACHINE PLANTER (PICKER TYPE).

landed my first potato-planter from America I had my 30-acre field about three-parts planted with the mould-plough, under which method we opened the drills with the plough, dropped the seed by hand, and then split the drill with the plough to cover. As soon as the new planter arrived it was put together and we finished the field with it. The machine-planted part came up better and stronger; at flowering-period the plants were fully 6 in. to 9 in. higher than those planted with the mould-plough and hand; also the greater mass of foliage kept all weeds down, while where the mould-plough was used there was a great deal of trouble with weeds. The result at digging-time was 13⅓ tons per acre from the part planted with the mould-plough and by hand, while 18½ tons per acre was obtained from the part planted by machine, also a very much better sample of potato. It was very dry windy weather when we were planting, and possibly the drills

dried up too much after the mould-plough, while the planter put the seed well down into a nice cool moist mould and covered them immediately.

Machine planting is undoubtedly the easier, quicker, and less costly method. One good man with two horses can plant from 4 to 5 acres per day, whereas a man with two horses and the mould-plough, and three other men to drop seed, would do about 2½ acres per day.

There are various makes of planters, comprising two types of machine —the picker type and the cup type. The picker type works with a set of six arms; on each arm are one or two needles and a finger-holder; these arms revolve through a magazine of seed-potatoes, the needles and finger pick up a seed-potato, carry it round until a releaser opens the finger, and the seed is dropped through a shoot into

SINGLE FIELD OF 130 ACRES OF POTATOES PLANTED BY MACHINE (PICKER TYPE), AT WILLOWBRIDGE.

This crop was grown by Mr. McGowan. The other two illustrations in this article are also from photos taken at Willowbridge.

the furrow, which a shoe on the planter opens and which is immediately covered by revolving disks. The cup type of machine has an endless chain to which are attached cups that pass through the magazine; the cup picks up a potato, carries it round, and deposits it similarly to the picker type. The cup-type machine requires two men to operate it—one to drive and the other to place a potato in every cup that comes up empty. The picker-type machine is operated by the driver only. Both these machines open the drill, plant the seed, cover and slightly mould same, and mark the next drill. There is also an attachment for sowing manure in the drill if required.

Farmers having neither machine nor mould-plough can use a single-furrow, a double-furrow, or a three-furrow plough. If a single-furrow

plough, plant every third drill; if a double-furrow, set the plough to 7 in. wide and plant every second round; and if a three-furrow, plant every round with the plough set to plough about 28 in. to 30 in. wide. In the earlier days, before planting-machines were thought of, we always planted with the plough, and I have seen some very fine crops grown this way.

Depth of Planting.—Here, again, there is a considerable difference of opinion. Naturally a great deal depends upon the class of land. If the soil is inclined to be very dry and sandy I would advise planting 5 in. deep; if inclined to be wet or in the case of old swamp land I would recommend planting not deeper than 3 in. to 3½ in., and then moulding up heavily; but for ordinary planting I would advise 4 in. The following experiment, conducted in 1912, is of interest in this connection: Plot 1, planted 1 in. deep, yielded 182 lb.; plot 2, planted 2 in. deep, yielded 188 lb.; plot 3, planted 3 in. deep, yielded 298 lb.; plot 4, planted 4 in. deep, yielded 317 lb.; plot 5, planted 5 in. deep, yielded 306 lb. In plots 1, 2, and 3 the tubers were much smaller, a great number were greened by the sun, and several unshapely. Plot 4 gave the best result both in quantity and quality. In plot 5 the quality was very good, but the extra inch of depth made the digging-out considerably harder.

Distance between Sets and Drills.—In regard to the distance between the sets in the drills the grower must be governed by the variety he is planting. If an early variety and a shy cropper, such as Robin Adair, Early Breeze, &c., 12 in. between sets is ample; but if it is one of the heavier-cropping kinds, such as Maori Chief, Gamekeeper, Up-to-date, &c., from 15 in. to 18 in. should be allowed. As regards the distance between drills, if it is intended to dig with a fork about 28 in will be found enough, but if a machine-digger is to be used fully 30 in. must be allowed, or the wheels of the machine will injure potatoes in the next row.

Points on different Classes of Seed.—Seed-potatoes specially sprouted for planting should be handled very carefully, for if the sprouts are injured in any way they will not grow. They must therefore be hand-planted in open drills. The potatoes should be brought out to the field in the box in which they are sprouted, and covered as soon as possible after being placed in the furrow. In the case of cut seed, I would not advise using a machine planter, as there is a tendency for it to miss in picking up the pieces; the same applies to planting table-size seed. The machine planter does satisfactory work only if the seed is well graded and not too large.

(To be continued.)

Soil-analysis.—It may be again stated for general information that the Department does not undertake the general analysis of samples of soil for individual farmers or other members of the public. Representative soils are analysed for lime-requirement, but only when the samples are taken by an officer of the Fields Instruction Branch. Inquiries should be addressed to the Instructor in Agriculture or the Fields Instructor for the district.

FERTILIZERS FOR TOP-DRESSING.

ALBERT F. ELLIS, New Zealand Phosphate Commissioner.

TOP-DRESSING has been of the greatest value in the past to farmers throughout New Zealand, and will undoubtedly continue to be in the future, probably to an increasing extent. Our existing permanent pastures can be kept in profitable condition largely by top-dressing at suitable intervals, and a great deal of the poorer country now lying idle throughout the Dominion will undoubtedly be put down in grass and kept going largely through the medium of top-dressing.

Probably the most important factor in bringing our poorer clay, pumice, or sandy soils into a profitable condition—assuming that they are either drained or do not require draining—is by increasing their humus content. Fortunately, the class of farming for which the Dominion seems eminently suited—namely, dairying and grazing—has the great advantage of developing the humus through the decaying of the grass and its roots and the droppings of the animals. Our policy of encouraging closer settlement, therefore, will have the effect of increasing the fertility of the country as a whole, and in this connection the suitability of fertilizers for top-dressing is of considerable importance.

BASIC SLAG AND BASIC PHOSPHATE.

In past years basic slag has had deserved popularity in New Zealand. In England and on the Continent of Europe it has an important place in agriculture, though, strangely enough, it is not used to any extent in the United States. During the last few years, however, there has been a material change in the manufacture of basic slag, and complaints in England are frequently heard to the effect that the slag is not what it used to be as regards giving results. There is a good reason for this falling-off in quality. The high-grade slag of previous years was produced as a by-product in the manufacture of steel by the Bessemer process, and this has been displaced by the open-hearth process, which yields a much poorer quality slag. In view of the importance of the old high-grade basic slag it might be contended that the steel-manufacturers should adhere to the Bessemer process, but they object to that and say it would constitute a case of "the tail wagging the dog."

A great deal of the open-hearth slag is further affected by the addition of fluor-spar in the process of manufacture; this lowers its citrate-solubility, and experiments have demonstrated the fact that, as might be expected, such slags are not so quick-acting.

The question of the poorer quality of basic slag has occasioned the Ministry of Agriculture in England a great deal of concern. Various suggestions have been made in regard to improving its quality, and these have at last assumed tangible form. Acting under the advice of its agricultural experts, the Ministry of Agriculture has approved of the sale of the United Kingdom quota of Nauru/Ocean phosphate to the South Wales Basic Slag Company. The phosphate will be finely ground and mixed in with the slag, bringing the quality up to 50 per cent. tribasic phosphate of lime. It is to be sold under the name of basic phosphate.

While the British farmers will undoubtedly benefit by this new phosphatic fertilizer, it can hardly prove of importance to users on this

side of the world when one considers the extra freights incurred on the more important part of the mixture—namely, the phosphate rock.

In view of the falling-off in the quality of basic slag the analysis of any shipments coming to the Dominion should be closely watched, and it should be kept in mind that a high percentage of phosphate of lime may be arrived at by mixing in some high-grade phosphate rock. It is commonly considered that phosphoric acid in basic slag exists as tetrabasic phosphate of lime, which is a more valuable form than the tribasic in phosphate rock, and to that fact may be attributed the remarkably good results obtained from the use of the previous high-grade slags. If, however, the new type of basic slag depends on phosphate rock for its high quality, as the recent development in England indicates, obviously the better course for the New Zealand farmer is to obtain finely ground phosphate, and thus get the benefit of the single freight incurred by bringing Nauru/Ocean phosphate direct to the Dominion.

BASIC SUPERPHOSPHATE.

Another top-dressing fertilizer which is much in favour is basic superphosphate. It may be considered as closely resembling the old high-grade basic slag in its results. The phosphate present exists as dibasic, an intermediate stage between the monobasic or water-soluble form, which constitutes the valuable feature of superphosphate, and the much less soluble tribasic form, as present in raw phosphate. Basic super is an alkaline fertilizer owing to the addition of lime, and it may therefore be used with advantage on sour soils where it would not be expedient to use superphosphate.

NITROGENOUS FERTILIZERS.

Bonedust, blood-and-bone, and other fertilizers containing nitrogen are used for top-dressing to some extent, and give rapid results at first; the lasting effects depend on the percentage of tribasic phosphate which they contain. Nitrogen stimulates the growth for a time, but the extraordinary way in which phosphate develops the root-system of the plant must be the principal factor in determining the value of a fertilizer for top-dressing. The Chemist to the Department of Agriculture (Mr. B. C. Aston) has repeatedly stressed the importance of concentrating on phosphatic fertilizers so far as this country is concerned, and there is good reason to think he is right, certainly as regards top-dressing. Bonedust, while a valuable fertilizer, is too high-priced so far as its phosphate-of-lime content is concerned.

FINELY GROUND RAW PHOSPHATE.

There is reason to think that finely ground raw phosphate will come into increasing favour for top-dressing purposes. Nauru/Ocean phosphate contains 85 to 88 per cent. tribasic phosphate of lime, and this supplies much more phosphoric acid per ton than any other fertilizer. Compared with basic slag of ordinary quality a ton of Nauru/Ocean phosphate contains practically as much phosphoric acid as 2 tons of basic slag. Therefore the saving in cost, including railage and cartage, is obvious. Throughout the Dominion we frequently see fertilizers being carried long distances by rail, water, and road, adding enormously to their cost. This expense of transport can be minimized by handling the highest-grade fertilizer, which certainly is the finely gruond raw phosphate from Nauru and Ocean Islands.

There is a good deal of misapprehension in regard to the grinding of the phosphate rock, and many people assume that if they can obtain an ordinary bone or lime mill they can grind the material, and thus obtain it at lowest prices. The position is that the phosphate rock must be ground to an exceedingly fine powder in order to render it available for plant-growth. The fineness should be at least 80 to 85 per cent. passing through a screen containing 100 holes to the linear inch. Special mills are therefore necessary for this work, and the various fertilizer-works throughout the Dominion are installing these. It would be false economy to use the phosphate in a coarse state to save the cost of fine grinding.

The users of the raw phosphate, when placing their orders, should obtain certificates as to the degree of fineness of the material. This is an important point, and cannot be too strongly stressed. When ground to the necessary fineness there need be no apprehension about the solubility, provided an ordinary rainfall is experienced. Though the phosphate present is in the tribasic state and insoluble in pure water, when applied to the soil it comes into contact with different conditions. The soil-waters contain carbon dioxide and weak organic acids in solution; these act on the phosphate, gradually rendering it soluble. This applies more particularly to sour soils, and there is no doubt that most of our New Zealand soils have a tendency to run sour.

A good alternative to the use of the finely ground raw phosphate alone is the addition of a proportion of superphosphate, thus supplying phosphoric acid in different degrees of solubility. This mixture would be of particular value in the event of a dry season. In such case it should not be considered that the less soluble phosphate would be lost; it would remain in the soil more or less unchanged, and become available when normal rainfall conditions set in.

Various phosphatic "guanos" and comparatively low-grade rock phosphates have for many years been used for top-dressing in the Dominion. The former have no more right to the designation of guano than Nauru/Ocean phosphate has. Probably all have a guano origin, but in such case the nitrogen, which is such a prominent feature in Peruvian guano, has long since been washed out by the heavy rains of the Pacific. It is frequently claimed for some of these phosphatic guanos that they are more soluble than Nauru/Ocean phosphate. That is open to question, and, provided the latter is ground to a fineness of at least 80 to 85 per cent. through the standard sieve of 100 holes to the linear inch, there is probably very little difference, if any, in solubility, while the percentage of phosphate of lime in Nauru/Ocean phosphate is undoubtedly very much higher than in any of the others.

EXPERIMENTATION.

In conclusion, the writer would stress the great importance of careful experiments with a view of demonstrating the value of top-dressing. The *Journal* of October last has a valuable article by the Department's Chemist, giving details of useful experiments conducted at Wallaceville with various fertilizers for top-dressing. It is clearly demonstrated that high-grade phosphate rock came out well, even though the material was imperfectly ground, the fineness being only 49 per cent. through the standard 100-mesh sieve. (A later article by Mr. Aston on the same subject was published in last month's *Journal*.)

THE PEAR-LEAF-CURLING MIDGE.

NOTES ON THE AUCKLAND INFESTATION.

DAVID MILLER, F.E.S., Entomologist, Biology Section.

DURING the summer of 1916–17 the foliage of pear-trees growing at Avondale, near Auckland, was first noted to be attacked by the larvæ of a species of midge which damaged the leaves in the same way as the pear-leaf-curling midge of Europe (*Perrisia pyri* Bche.). As, however, there is a considerable amount of generic and specific confusion concerning this group of flies, it cannot be definitely stated that the pear-midge in New Zealand is the *P. pyri* of Europe until the result is known of the comparison of specimens sent from the Dominion to Europe.

P. pyri is distributed throughout Europe, infesting pear-trees in Norway, Sweden, Denmark, France, Switzerland, Italy, Spain, and England; but except for occasional outbreaks this midge causes comparatively little damage in its native surroundings, and is no doubt kept in check to a very great extent by its insect parasite (*Inostemma piricola*), which also parasitizes another midge injurious to pears—the pear-fruit midge (*Contarinia pyrivora* Riley), closely related to *P. pyri* both systematically and in habits, the larvæ of the former infesting the young fruit and of the latter the young leaves.

The radius of pear-leaf midge infestation in New Zealand extended from Avondale during the seasons following 1917 until at the present time the midge is present over the southern part of Waitemata County, Eden County, and parts of the Waikato district. During the spring of 1920 the midge was noted for the first time in the Hawke's Bay District, infesting to a limited extent a block of orchards running north-east and south-west on the eastern side of the railway from Hastings towards the coast. At the present time the pear-leaf midge causes very extensive devastation in those parts of the Auckland District mentioned, where it is a matter of impossibility to grow young pear-trees or nursery stock. In the infested part of Hawke's Bay the position is not yet serious apart from the establishment of the midge.

THE MIDGE AND ITS METHOD OF ATTACK.

In the badly infested area the midges may be seen in swarms flying about and alighting upon the foliage of the trees. The adult midge (Figs. 1 and 2) is a minute insect with a pair of blunt transparent wings, along the surface of which and running parallel to the front edge from the root to the apex is a conspicuous supporting ridge. The female measures about $\frac{1}{25}$ in. in length, its head and thorax are blackish, the legs rather paler, and the abdomen orange-red to brownish; the apex of the abdomen is pointed, and may be extended to a considerable length as a delicate and hair-like egg-tube—the ovipositor. The

male is smaller than the female but of much the same colour, though the abdomen is not pointed, but thickened apically.

The unfolded or fully developed pear leaves are not attacked, but as soon as a young leaf bursts from the bud, and before it unfolds, one or more female midges alight upon the leaf and deposit their eggs between the folds. If a female be watched it will be seen to walk over the curled-up leaf, dragging over the surface its long ovipositor until the tip enters the groove formed by the folding of the leaf. The midge then thrusts the ovipositor between the folds and deposits her eggs, as many as thirty-five having been seen laid at one time. Each egg is cigar-shaped, very small, reddish-yellow or pale yellow in colour, and translucent when freshly laid, becoming more opaque with the development of the embryo. As egg-laying proceeds the midge moves along the furrow of the leaf and so distributes the eggs in clusters or singly along the full length of the fold. Some of the eggs may be deposited on the outside of the leaf before the ovipositor finds the fold, but the larvæ from these on hatching out are exposed and perish. The larvæ on hatching from the eggs within the curled leaf are admirably protected, and the upper epidermis of the leaf, being curled inwards, is attacked and rendered moist and flaccid.

FIG. 1. ADULT FEMALE PEAR-LEAF MIDGE, ENLARGED. ACTUAL SIZE ABOUT $\frac{1}{16}$ IN. LONG.

FIG. 2. ADULT MIDGE AT REST ON PEAR-TREE TWIG, × 2.

The infested leaf continues to grow rapidly, but, though it greatly lengthens, through the destructive action of the larvæ it is unable to unfold, and this, combined with the lateral growth, causes the leaf to curl further inward from each side along the midrib in the form of a double tube. As growth advances the surface of the leaf becomes crenulated and rapidly turns black, ultimately becoming hard and brittle as the larvæ mature. Though usually the whole leaf is infested by many larvæ there are occasions when only a few are present and attacking in one spot. At such times the uninfested portion of the leaf develops normally, though the infested part remains folded and black.

CLASSES OF TREES ATTACKED.

So severe is the infestation in the Auckland District that nursery stock and young orchard-trees up to three years of age are almost or completely defoliated, and the growth, in consequence, is practically arrested (Fig. 3). Older trees up to eight years of age also suffer severely, particularly on the terminal shoots, which are so greatly stunted that the growth may be measured in inches instead of in feet; the development of the fruit is also decidedly hindered. Nine-year trees and over are attacked, but usually not so severely as to hinder the development of the trees and the crop.

All commercial varieties of pear grown in the infested areas are subject to infestation, though strong growers and early-leafing varieties are, if anything, not so severely attacked, the latter types having had a chance to commence the season's growth to a great extent unhindered by the first spring emergence of the midge. The Chinese birch-leaf variety, which is used as stock, was found to be practically immune from midge attack; in a bed containing two-year-old seedlings 7·5 per cent. showed slight infestation, the remainder being free from attack. When used as stock the shoots from the birch-leaf variety are immune, while the grafted forms on the same stock were severely infested (Fig. 4).

LIFE-HISTORY OF THE MIDGE.

The eggs hatch after four days from the time they are laid, and the young semi-transparent larvæ attack the leaf, which five days later commences to turn black. Six to seven days later the leaf is totally black, and commences to dry up and turn brittle (Figs. 5 and 6). Just before the leaf hardens, the larvæ, which have matured, work their way out from the curled leaf and drop to the ground, into which they immediately burrow to an average depth of 2 in. to 3 in. When soil from ground infested by midge-larvæ was carefully removed to depths varying from 1 in. to 3 in. it was found that no midges emerged from a greater depth than 3 in. In some cases the leaf dries up and imprisons some of the larvæ, particularly those hatching from a batch of eggs laid on a leaf already infested. These imprisoned larvæ perish owing to the lack of moisture and inability to escape.

The freshly hatched larvæ are white and semi-transparent, but as they grow they become pearl-white and opaque, and when mature, just before they drop from the leaf to the ground, turn yellowish or reddish. If an infested leaf be uncurled large numbers of larvæ will be found within the folds (Fig. 7); the larvæ will not remain in a leaf which has been thus opened and closed again, but will seek the ground and pupate, although not full grown, the pupal period being slightly lengthened. The very young larvæ, however, are less readily disturbed from the leaf. If the surface of the ground is hard or covered by weeds or grass the midge-larvæ crawl under any obstacle such as a lump of earth, or into any crevice which will give the requisite shelter and moisture. In well-cultivated orchards where the soil is loosened below the surface the larvæ will go to a greater depth. They are very active, and, legless as they are, can move fairly rapidly along the ground; but they do not travel far, seeking shelter usually at the spot where they land from the tree. Once in the ground, though present in large numbers, the larvæ are very difficult to find, principally owing

FIG. 3 (LEFT). VIEW SHOWING EFFECT OF MIDGE INFESTATION ON PEAR NURSERY STOCK.

FIG. 4 (RIGHT). NURSERY STOCK: ON LEFT HAND A GRAFTED VARIETY INFESTED BY MIDGE; ON RIGHT HAND A SHOOT FROM THE CHINESE STOCK, UNATTACKED.

to their small size and to their habit of lying in the crevices of lumps or under particles of earth.

When in the ground the larvæ transform to pupæ, and from ten to fourteen days after dropping from the tree the adult midges emerge from the soil and fly on to the trees. The life-cycle from egg to adult occupies a period of from twenty-five to thirty days, the duration being longer early in the season but shorter during the warmest months. The larvæ winter-over in the ground, the adults emerging in the spring.

SEASONAL HISTORY OF THE AUCKLAND INFESTATION IN 1920–21.

In the spring of 1920 the first generation of adult midges in the infested areas, near Auckland, emerged during the latter half of September and early in October. A severe infestation of the young leaves

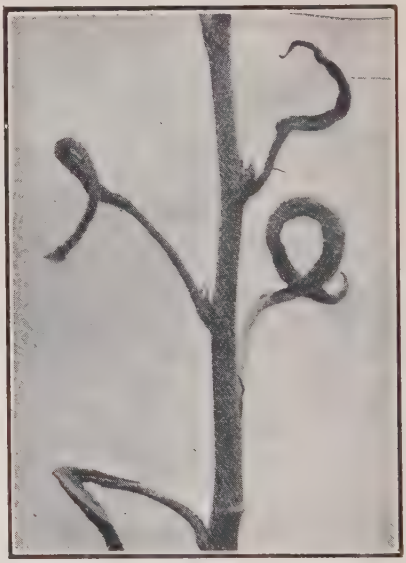

FIG. 5 (LEFT). YOUNG PEAR-LEAVES INFESTED BY MIDGE-LARVÆ.
FIG. 6 (RIGHT). PEAR-LEAVES COMPLETELY KILLED BY MIDGE-LARVÆ.

resulted, the blossoms in some cases wilting owing to loss of nutrition. On the larvæ of this brood falling to the ground the trees threw out new leaves and commenced to grow rapidly, but the growth was again checked in early November by the emergence of the second generation of midges, which continued on the wing to the latter part of the month. Owing to the prolonged period during which the adults and therefore the larvæ of the second generation were active, the period between this generation and the third, which emerged in mid-December, was comparatively brief, and very little healthy foliage was made by the trees. The third generation was so great that it overlapped the fourth emerging in early January, and no growth nor healthy leaves developed, overlapping larvæ being active at the same time as others were pupating in the ground. By the end of January the last of the fourth generation of

larvæ were pupating, and the trees developed normally for a brief period until checked by the larvæ of the fifth generation, the adults of which emerged in early February. A slight development of normal growth took place after the larvæ of this generation pupated, but was again checked at the end of February by the emergence of the sixth generation; by the middle of March the larvæ of this generation had entered the ground. Toward the end of March and early in April a few midges were on the wing, but by this time infestation had ceased.

During last season, therefore, there were at least six generations of the midge, increasing in extent until the maximum was reached when the third and fourth overlapped. At that period the lack of sufficient food-supply caused by the severity of the third infestation resulted in a considerable portion of the fourth generation being ineffective, progeny developing from comparatively few. The fifth generation was very much smaller, and the sixth smaller still, the food-supply of the latter being restricted not only by the result of the attack of the former generations upon the growth of the trees, but also by influence of the season, when many of the trees had ceased to throw out new foliage, young leaves being found only on such late-growing varieties as P. Barry.

The midge-larvæ winter-over in the ground beneath the trees from which the last generation has dropped in the autumn. Apparently, therefore, it is only the soil beneath the late-leafing varieties of pear which is the seat of infestation in the following spring, since those trees which ceased growth before the emergence of the last autumn generation of adults would not be infested by the larvæ of these insects, which would necessarily concentrate upon the young leaves of the late-leafing varieties.

FEATURES OF CONTROL

The pear-leaf midge readily spreads from one place to another. It may be carried great distances from an infected area to other parts, in soil infested by the larvæ. Once established in one area the adults rapidly spread on the wing if left to themselves, but more rapidly by the agency of the wind. The greatest care should be taken in exporting from a midge area not only pear-trees but all nursery stock, since it requires but very little soil infested by midge-larvæ, which may become attached to the roots of nursery stock, to spread this pest broadcast over a wide area.

Experiments for the control of the pear-leaf midge based on the following principles are being carried out, the detailed results of which will be published later on. The principal factors are (1) the chemical treatment of susceptible trees and (2) of infested ground, (3) the cultivation of infested ground, and (4) the utilization of insect enemies. These factors are correlated with one or more of the following periods in the life-cycle of the midge: (*a*) The adults as they emerge from the ground; (*b*) the adults on the wing; (*c*) the eggs in the curled leaves; (*d*) the larvæ in the curled leaves; (*e*) the larvæ as they drop to the ground; (*f*) the larvæ in the ground.

Since the eggs are deposited within the folds of the young leaf, and the larvæ are admirably protected within, neither can be reached by sprays, and are consequently invulnerable to such methods of control. As they drop from the leaves, however, the larvæ are unprotected for

a brief period, and experimentally were trapped on "Tanglefoot" paper or cloth spread under the trees on the ground; but this method, of course, is quite out of the question from a practical point of view. The first, second, and sixth periods (particularly the sixth), however, present possibilities for extensive control. The treatment of the ground infested by larvæ and emerging adults is one of the most important methods by which the midge can be attacked.

In the first place it should be borne in mind that ground-treatment affords frequent opportunity of attacking the midge, since there are seven periods from spring to spring when the larvæ are in the ground—namely, six brief periods from spring to autumn, and one protracted period during the winter months.

Infested ground may be treated chemically and by cultivation. Experiments showed that when infested ground was covered to a depth of 4 in. by uninfested soil no midges emerged, though swarms were emerging from adjoining ground left uncovered. Another method which gave good results, though all the midges were not prevented from emerging, was by carefully turning over infested ground with a spade, taking care that none was left unturned. By frequently raking over the ground and disturbing the buried larvæ there was a marked effect upon the numbers of midges which emerged. During the season—from spring to autumn—when the midge is active the periods for ground-treatment may be gauged by the development of uninfected foliage on the trees, since when normal growth is showing the midge-larvæ are in the ground. The area of trees beneath which the ground is to be treated during the winter is apparently less than that treated during the active season of the midge, since, as already stated, many varieties of pears cease growth earlier in the autumn than others, and consequently it is only the late-leafing varieties which are infested by the last autumn generation of the midge, the larvæ from which winter-over beneath these late-leafing varieties only. Experiments are being carried out on this important feature. An important factor in the control of the midge is the prevention of all root-suckers from developing, since they are excellent breeding-grounds for the pest.

FIG. 7. AN INFESTED PEAR-LEAF UNCURLED, SHOWING MIDGE-LARVÆ.

Of the various chemical substances so far experimented with in ground-treatment, kerosene, tar-water, and naphthalene were the most efficient in destroying the larvæ in the ground. Kerosene undiluted gave excellent results when sprayed on the ground, not a single midge emerging; but, unfortunately, the price of kerosene prohibits its use

FIG. 8 (LEFT). EIGHT-YEAR-OLD PEAR-TREE WITH ITS TERMINALS DEFOLIATED BY THE MIDGE-LARVÆ.

FIG. 9 (CENTRE). EIGHT-YEAR-OLD TREE WITH TERMINALS PREVIOUSLY DEFOLIATED, BUT NOW SHOWING NORMAL GROWTH, THE MIDGE BEING IN THE GROUND.

FIG. 10 (RIGHT). PEAR-SHOOT SHOWING PERIODS OF INFESTATION AND NORMAL GROWTH.

(The white conical object in figure 8 is a trap-tent, used in noting the emergence of adult midges from the soil.)

undiluted on a large scale. Kerosene emulsion, either dilute or strong, was quite ineffective. Spraying the ground with a strong solution of tar-water prevented all midges from emerging, but weaker solutions were not so satisfactory. A tar-oil procured from the gasworks and sprayed on the ground gave good results, and a strong emulsion of this oil was fairly effective, but less so than the pure oil. Experiments with this oil are still being carried on. Solutions of potassium sulphide sprayed on the ground gave negative results, even when of considerable strength and used copiously. Shallow injections of carbon bisulphide in varying proportions were quite ineffective.

An endeavour is being made by testing various substances to find some suitable deterrent spray which will prevent the female midges from alighting on the young leaves to lay their eggs.

With regard to insect enemies, no parasites of the pear-leaf midge have been bred out in the infested areas, though certain predaceous insects prey upon the midge, but not sufficiently to check the depredations of the pest. A very common insect to be found hunting the adult midges is a small and delicate brilliant green or bronze native fly (*Psilopus mobilus*), which is very active and captures its victims on the wing. Another native insect, the damsel-fly (*Austrolestes colensonis*), is also a great hunter of the midge. The larvæ of an unidentified ladybird beetle were frequently met with in soil infested by midge-larvæ, and in confinement this ladybird-larva rapidly cleaned up midge-larvæ. Whether or not this predaceous insect is of much use in a free state is being noted. The midge-larvæ as they drop from the leaves to the ground, as well as the adult midges flying about the trees, are frequently ensnared in the webs of a small species of epeirid spider very common in the midge-infested areas.

The writer's acknowledgments are due to Messrs. Platts, of Henderson, for their valued assistance in making observations in their orchard; also to Mr. F. Firth, of Oratia, for similar work. Figs. 2, 4, and 8 are from photos by Mr. W. Walrond, of Auckland.

ASSOCIATION HERD-TESTING.

SUMMARY OF RESULTS FOR 1920–21 SEASON.

W. M. SINGLETON, Acting Director of Dairy Division.

DURING the past season the Dairy Division continued the operating of herd-testing associations at the same centres as in the preceding year, and to these were added eleven others, bringing the total to thirty-three associations. The total number of cows tested was 9,349, as compared with 7,591 during the 1919-20 season. At the beginning of the past season there was a dearth of testing-requisites used by the dairy-farmer, and for this reason associations could not be commenced at some dairy factories where the companies and a number of the suppliers were anxious that a start should be made. It is hoped that some of these proposed new associations will be operative during the ensuing season.

The past season was not so good as its predecessor from the standpoint of production. The exceedingly dry autumn generally experienced not only caused many cows to yield less during that period, but was also conducive to a shorter milking-period for the season. In those associations where the samples were tested by our officers and the records computed in the Division's head office the average cow recorded a credit of 210·92 lb. of butterfat in a milking-period of 218 days, as compared with 230·25 lb. produced in 223 days for the preceding season.

The figures for the 1920–21 season are as follows:—

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Fat.	Days.	Fat.	Days.	Fat.
			lb.		lb.		lb.
1 ..	444	237	253·94	243	315·05	191	192·11
2 ..	494	160	129·84	166	199·57	103	79·13
3 ..	222	199	191·10	263	264·33	168	115·20
4 ..	63	196	181·46	282	282·47	117	90·93
5 ..	80	241	250·24	264	304·58	209	174·79
6 ..	423	200	204·94	222	239·14	163	159·90
7 ..	577	235	242·96	267	300·42	149	152·91
8 ..	176	185	226·04	263	318·61	128	146·22
9 ..	100	245	231·93	254	236·01	236	227·85
10 ..	628	230	216·30	274	293·16	139	117·16
11 ..	156	221	208·37	249	311·18	106	81·80
12 ..	334	234	237·23	266	312·90	147	152·98
13 ..	297	212	210·95	275	302·01	114	118·58
14 ..	138	246	241·53	248	278·04	238	189·29
15 ..	124	236	203·52	239	236·24	223	157·65
16 ..	283	243	251·68	267	333·14	100	68·15
17 ..	56	205	247·12	214	358·13	108	124·19
18 ..	150	262	220·12	266	265·37	260	180·51
19 ..	370	240	239·96	275	345·15	115	158·39
20 ..	276	228	248·83	240	330·75	146	191·79
21 ..	359	213	168·01	273	391·83	150	84·84
22 ..	941	192	181·89	247	268·93	120	57·61
23 ..	208	178	177·50	216	210·23	112	118·57
24 ..	298	193	181·99	224	295·21	131	91·98
25 ..	269	228	231·01	256	324·30	162	177·08
26 ..	512	165	155·17	242	230·09	128	78·45
27 ..	174	185	182·93	227	225·76	205	138·88
28 ..	467	183	193·61	241	276·17	116	89·82
29 ..	138	236	227·33	233	237·79	217	169·08
30 ..	293	228	250·42	264	292·55	218	188·88
31 ..	123	258	247·77	274	304·11	241	189·02
32 ..	84	172	173·78	228	238·45	126	106·82
33 ..	92	216	214·98	250	307·73	135	154·29

	Days.	Pounds Fat.
Grand average of associations	215	212·86
Grand average of all cows (9,349)	218	210·92
Highest association average	237	253·94
Lowest association average	160	129·84
Highest individual herd	273	391·83
Lowest individual herd	120	57·61
Highest individual cow	306	574·25
Lowest individual cow	102	33·60
Average daily production of butterfat per cow ..		0·9691

Almost one-half of the associations running prior to last season increased the production of their average cow during 1920–21 despite unfavourable climatic conditions. The lower average for the associations as a whole is accounted for to some extent by the fact that some of the associations started in 1920–21 were in districts which are not yet fully developed and where a greater number of the farms are only in a partially improved state.

During the past two seasons a number of breeders have had cows on both the certificate-of-record and the association test. We have been interested to see how far the association test confirmed the C.O.R. figures. The results are as follows: Number of cows, 31; average number of days in milk, 252; total fat (C.O.R.), 11,334·39 lb.; total fat (association), 11,127·12 lb.; difference (total), 207·27 lb.; total number of days in milk (same both sytems), 7,820; average fat per cow (C.O.R.), 365·63 lb.; average fat per cow (association), 358·94 lb.; difference per cow, 6·69 lb.; per cent. excess of C.O.R. over association system, 1·86. These figures are instructive, and give a clear indication, as far as they go, that the association principle of testing is quite as near a guide as the dairy-farmer requires for the purpose of estimating the productive value of his cows. The breeders who carried out these comparisons would take samples carefully, this being essential to accuracy. These figures are not a selection, but are compiled from all records available in this office for the past two years, and where cows have been tested under both systems during the same season.

Eight other associations had their work supervised by Farm Dairy Instructors attached to the Dairy Division, the number of cows tested being 6,131. The testing and figuring were done by these officers in addition to their work of instruction on the dairy farms relative to the care of milk and cream. The summary figures for these associations are as follows:—

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Fat.	Days.	Fat.	Days.	Fat.
			lb.		lb.		lb.
1 ..	1,391	..	179·00	..	328·00	..	95·00
2 ..	1,429	221	236·07	289	353·18	150	125·12
3 ..	690	180	147·64	219	221·98	169	92·85
4 ..	1,518	213	220·99	231	308·26	188	137·91
5 ..	189	216	226·04	257	341·42	197	124·80
6 ..	171	189	203·39	157	240·93	182	159·82
7 ..	355	220	201·59	245	287·27	177	119·27
8 ..	388	..	190·00	..	338·00	..	110·00

	Days.	Pounds Fat.
Average of associations	207*	200·59
Grand average of all cows (6,131)	210*	199·55
Highest association average	221	236·07
Lowest association average	180	147·64
Highest individual herd	289	353·18
Lowest individual herd	169	92·85
Highest individual cow	275	556·21
Lowest individual cow	154	59·92
Average daily production of butterfat per cow ..		0·9959*

* Exclusive of associations Nos. 1 and 8.

The average cow in the forty-one associations tested and figured by officers of the Dairy Division thus works out at 206·42 lb. of butter-fat in a milking-period of 215 days for 15,480 cows. Quite a number of cows which were tested for only a portion of the season have not been included in the summaries.

It is hoped that the publication of these results will inspire other dairy-farmers to undertake herd-testing. The appliances which are now coming on the market should facilitate the weighing and sampling of the milk from individual cows that are being milked by machines with the releaser. These appliances for sampling will be further perfected, and as a demand for their installation grows we are hopeful that the manufacture of increased numbers will lessen the cost of production and also the price to the farmer.

Comparatively, New Zealand has no reason to be ashamed of the proportion of her dairy cows being tested. Moreover, there is no reason to doubt our ability to lead in this respect, and we trust to see the number of dairy cows on test increase very materially in the near future.

THE WATER CONTENT OF HONEY.

NEW ZEALAND HONEY'S HIGH FOOD VALUE.

F. A. JACOBSEN, Apiary Instructor, Wellington.

At the Annual Conference of the National Beekeepers' Association, held at Auckland last June, I made reference to the high food value of the honey produced in New Zealand. A number of leading bee-keepers were keenly interested, and asked me to go into the matter fully and publish such information, also to explain clearly the working of the hydrometer as a test of specific gravity. It will be readily conceded that the lower the water content the higher will be that of the remaining solids, and consequently the greater will be the food value. It follows that dry honeys should command a higher price than those containing a large amount of moisture, and it is with the establishment of this fact that the beekeepers of the Dominion are chiefly concerned.

Analyses of honeys throughout the world have been made from time to time by men of repute. C. A. Browne, Chief of the Sugar Laboratory of the United States, in 1908, gave the average water content of American honeys as 17·59 per cent. No less than ninety-nine samples gathered from various flora throughout the United States were analysed, and the percentage of moisture ranged from 12·42 to 26·88 per cent. The Committee on Food Standards in the United States allows up to 25 per cent. of water, as also do the German Vereinbarungen. In Germany the average water content of 138 samples of pure honeys examined by Konig was 20·60 per cent., and of seventeen samples listed by Lehmann and Stadlinger 19·30 per cent.

In New Zealand the maximum quantity of water allowed in honeys under the Sale of Food and Drugs Act is 20 per cent. (regulation

gazetted in 1913). Of fifty-one samples of pure honey forwarded to Wellington from all parts of the country the Dominion Analyst, Dr. Maclaurin, reported, in 1914, the average water content to be 15·58 per cent., the lowest being 14·43 per cent. and the highest 18·10 per cent. This latter sample was unripe and would not have passed for export. The system recommended by the Apiary Instructors and largely adopted by the producers—that of leaving the honey in the hives until it is "capped"—is largely responsible for the bulk of our honey being "dry" or "ripe." The occurrence of humid conditions militates against the production of dry honeys, and care should be taken against any undue exposure to the atmosphere.

Writing recently in the *American Bee Journal*, Mr. F. Dundas Todd remarks on "New Zealand honey as sold abroad with 10 per cent. more sugar content than honey of the minimum legal standard of the North American Continent, and should be worth just that much more money." The virtual truth of this statement is shown by the figures already quoted—namely, that our average water content is 15·58 per cent. and the maximum legal standard of the United States 25 per cent. The maximum percentage in Canada is the same. New Zealand honey thus contains a greater average sugar content than that of honeys from other leading honey-producing countries.

It appears that the time is not far distant when large honey-buyers will purchase their supplies on the basis of the sugar content definitely ascertained. By this method payment would be made for the solids and not for the water, which is of no value. Alcoholic beverages are tested for alcoholic content and paid for accordingly. Chemicals and manures are sold on their analytical value with reference to their specific designated values, therefore why should not honey be dealt with in the same way? There is evidence of at least one Canadian beekeeper who, having produced honey of a high specific gravity, used the argument as a selling-platform with such effect that he cleared 1d. per pound more than previously for the whole of his crop of nearly 3 tons.

SPECIFIC GRAVITY AND THE HYDROMETER.

The specific gravity (sp. gr.) of any body is the weight of the body compared with that of an equal bulk of water at a given temperature. Knowing the weight of any volume of water in any system of weights and measures, and the sp. gr. of any substance, we can calculate the weight of any volume of the substance. A cubic foot of water weighs 1,000 oz., and its specific gravity (sp. gr.) is expressed as 1; a cubic foot of iron weighs 7,800 oz.; therefore the sp. gr. of iron is 7·8, or nearly eight times that of water. Other examples which may be cited are a cubic foot of alcohol weighing 790 oz., with a sp. gr. of 0·790; and a cubic foot of milk weighing 1,030 oz., sp. gr. 1·030. Water has been adopted as the basis of measuring solids and liquids, but not gases, as that would be too inconvenient.

In the case of liquids Mr. Todd makes a very clear explanation, and I will quote him in the following extract: "A rather simple method, in the case of fluids, has been devised, based on the fact that in the case of an object lighter than water, one that will float, the amount of water it displaces will be exactly the same weight as the

object. For example, if we take a block of oak 1 in. square and 14 in. long — that is, of 14 cub. in. capacity — and dip it into a vessel containing water, we find it will sink to a certain depth, displacing some water, and raising the water-level until the weight of water displaced is exactly equal to that of the wood it buoys up. Now, if we guide the wood to a perfectly upright position we will find that it will sink to about 10 in. in the water, and has therefore displaced 10 cub. in. of the fluid. Therefore we find that 10 cub. in. of water are equal to 14 cub. in. of oak. The latter, then, is—cubic inch by cubic inch, or cubic foot by cubic foot—just ten-fourteenths of the weight of water; or, expressed in the regular form of a decimal fraction, 10 divided by 14 is equal to 0·714, the specific gravity of oak. Our oak stick can now be used as a measuring-rod for a great many other liquids. For instance, we may have a strong solution of salt in water—brine, in fact—so we dip our oak stick in it and find it will sink only 9 in. So 9 cub. in. of brine equal the weight of the stick, but so did 10 cub. in. of pure water, hence 9 cub. in. of brine and 10 cub. in. of water are equal in weight to each other. We might say that brine is 10-9ths or $1\frac{1}{9}$ times the weight of pure water; that is, its specific gravity is 1·11."

The same experiment could be tried on honey (a sample of well-ripened honey), and it would be found that the oak stick would sink only 7 in. Therefore 7 cub. in. of such honey would be equal in weight to 10 cub. in. of pure water; consequently the honey would be $1\frac{3}{7}$ times the weight of water, or, expressing it in proper form, the specific gravity of the honey would be 1·42.

The stick of wood is really a measure, and as it is mostly used in water solutions it is called a hydrometer. The stick, however, has a few drawbacks. In the first place it is rather bulky, necessitating a large quantity of fluid to float it, and it has an awkward habit of falling over. Science has therefore devised something very much more convenient in the form of a glass tube containing some mercury or small shot in a bulb at the bottom of the stem, so as to make it float vertically in any liquid. The depth to which the instrument sinks indicates the specific gravity of the liquid, which is recorded on the stem. It will have been noted that the stick sank deepest in pure water and less in water containing common salt, so in graduating hydrometers zero is always placed at the top.

There is quite a long range between pure alcohol with a specific gravity of 0·79 and honey with a specific gravity of 1·42, so hydrometers have been devised to meet the various requirements. Broadly speaking, there are two groups of hydrometers, one to use in solutions lighter than water, such as alcoholic beverages, oils, &c., and the other in solutions heavier than water, such as brine, milk, honey, &c. It is with the measures of the latter group we are now concerned.

When hydrometers were first devised the natural thing to do was to make the scale with equal divisions, and the Beaume scale is so graduated. Experience ultimately proved that the relationship was more complex, so Twaddle devised a scale in which the divisions are not at equal distances apart, but closer together at the bottom, thus compensating the instrument. Users of the Beaume scale have to refer to tables to learn what specific gravity is indicated by the observed figures, whereas users of the Twaddle scale simply multiply the reading

by 5, place a decimal point in front of the answer, then place 1 for the specific gravity of water in front of the decimal point. Either scale is good so long as one knows what one is doing.

We have found that for testing clover honey, or honey that is easily extractable, a Twaddle No. 4 with a range from 102 to 74 is the correct one to use. The test should be made at 60° F., but as the temperature rarely goes so low in the summer it may be taken at 70° or 80° by adding one point to the hydrometer-reading for each ten degrees of heat over 60°. Thus, if the hydrometer sinks to 82 at a temperature of 80° it would register 83 if taken at 70° and 84 if taken at 60°. To arrive at the specific gravity multiply the hydrometer-reading by 5; thus 84 × 5 = 420; add 1 for the specific gravity of water and it will be 1·420. This method is only reliable up to a temperature of 90°. Honey registering below 1·42 is not considered sufficiently ripe for export.

Sometimes the honey is so dense that the hydrometer will not sink. When such is the case take equal parts by volume (not weight) of honey and water, mix thoroughly, test with a No. 2 Twaddle hydrometer, and then multiply the result by 2. This will give the same result as if taken with a No. 4 instrument by the direct method. Thus, if the No. 2 instrument sinks into the honey and water to 42, this multiplied by 2 = 84. Perhaps the quickest and simplest method to test thick honey is to have a deep glass or beaker on which is a mark to contain about 4 oz. of water. Fill up to the mark with water, then pour it into another vessel; now fill up to the mark with liquid honey, add the water previously measured, and mix thoroughly; then place in it the No. 2 hydrometer, note the number to which it sinks, and multiply by 10; place the decimal point before the result, and add 1. Thus, if it registers 43, 43 × 10 = 430; place the decimal point before the 430 = ·430; to this add 1, which is the specific gravity of water, and the result will be 1·430.

The hydrometer is made with various scales, according to the density of the liquid to test which it is required. Each degree is equal to 5 degrees sp. gr.; for example, 80 degrees on the Twaddle instrument is equal to 1·400 sp. gr., as 80 × 5 = 400 plus 1,000 = 1·400 sp. gr.

The cost of the appliances is a mere nothing compared with the importance of making tests, as every beekeeper should take steps to arrive at a reliable standard for ripe honey.

Two instruments with a range from 1·350 to 1·400 and 1·400 to 1·450 respectively, with a suitable test-glass and thermometer, cost about 12s. or 14s.

I trust the foregoing notes will give beekeepers of the Dominion a more complete understanding of the hydrometer and its uses, and duly emphasize the value which may in future be attached to a ripe and dry honey.

Library for Soldiers at Ruakura.—The sum of £100 has been donated by the Hamilton branch of the St. John Ambulance Association towards a library for the returned soldiers' quarters at the Ruakura Farm of Instruction.

ELECTRIC POWER FOR MILKING-PLANTS.

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[From the *New Zealand Journal of Science and Technology.*]

DAIRYING promises to develop into the main industry of New Zealand. Already the exports of butter and cheese for the year ended 30th June, 1921, have amounted to £16,823,693 in value, out of total exports of £50,821,881—*i.e.*, over 33 per cent. At the present prices of our staple products this year's proportion for dairy-produce will be even higher, and the higher proportion will probably be maintained for some time. On 30th April, 1920, there were 35,643 milk-suppliers to the dairy factories, and the number is increasing at the rate of about 10 per cent. per year. Of these 8,806 were using milking-machines requiring 2 to 3 horse-power each. This number is increasing at the rate of 16 per cent. per year, and will grow rapidly until it approaches the number of milk-suppliers. The total demand for this purpose alone will thus run into tens of thousands of horse-power, and will constitute a large proportion of the total demand for hydro-electric power in the Dominion. In fact, it is becoming clear that the milking-machine motor will be the main justification for a large proportion of the country reticulation. A revenue of £24 to £30 is available from the average dairy farm for the milking-machine alone. This justifies the line; and when the line is once run to the farm all kinds of other uses are found for electricity—lighting, ironing, cooking, heating, and power generally. But the peak load on the farm service in the dairying districts will be at the milking-hours, morning and evening.

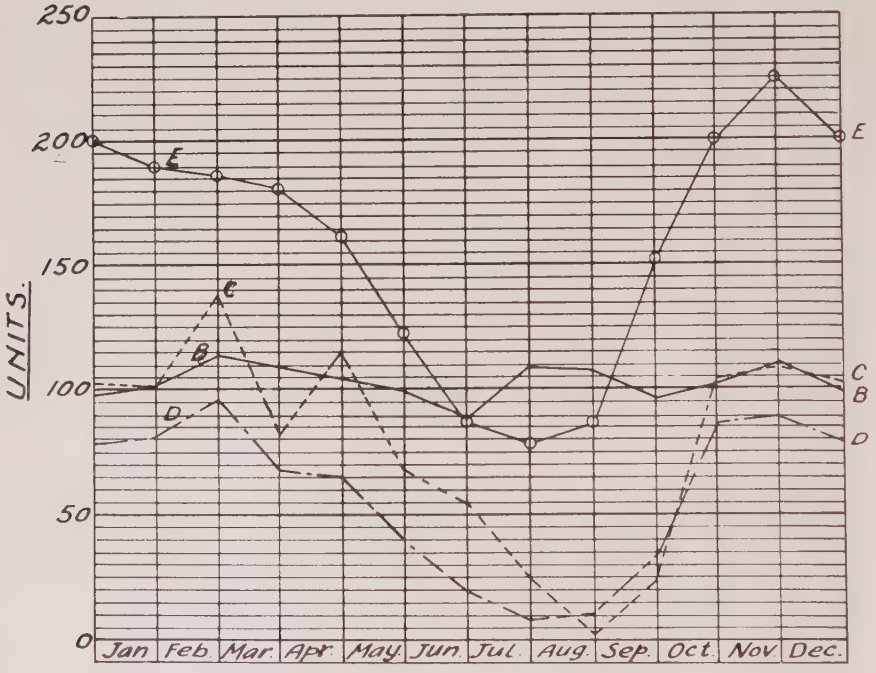
In view of the difficulty of making country lines pay their way it is important to keep down the size of wire—*i.e.*, the current and power consumption—and with the object of investigating this matter a series of meter tests have been made on five typical milking-plants in the Canterbury District. These tests are intended to determine—(*a*) The power required to drive the average milking-plant; (*b*) the consumption of energy in such a plant over an average season.

No attempt is made in this article to differentiate between the energy taken by different makes of milking-machine on the market. This is an important investigation which will be undertaken in due course, but it is only reasonable that the makers should submit plants for this purpose in the best working-order in each case for comparative purposes. The object of the present investigation is rather to determine not the lowest consumption under the best conditions in each case, but the general consumption of power under ordinary working-conditions, and for this purpose the plants were selected at random. A 3 h.p. motor is employed in each case, although the tests indicate that a 2 h.p. would have been sufficient for at least four out of the five, and probably, with a little improvement in the conditions of operation, for the fifth as well. This is important from the point of view of the economy in the mains, as the idle magnetizing-current for a 3 h.p. motor will be approximately

50 per cent. greater than for a 2 h.p. motor, and this magnetizing-current has to be supplied continuously as long as the motor is running, whether there is any load or not.

As a result of these tests 2 h.p. motors have been installed on several similar and even larger plants with quite satisfactory results, and this size is now being standardized for milking-machine drives generally.

When the number of machines connected to a reticulation system runs into thousands, as it will in many of the electric-power districts being formed, the reduction from 3 h.p. to 2 h.p. each will mean that current equivalent to many hundreds of horse-power will be available for other industrial purposes which would otherwise have to be reserved for the magnetizing or idle current of the unnecessarily large motors.



CURVES OF MONTHLY ENERGY-CONSUMPTION FOR THE MILKING-PLANTS TESTED.

The results of the tests taken are detailed in the table on next page, and the curves herewith give the distribution of the demand over the various months of the year. The tests were taken on five representative milking-plants in Canterbury operating from the Lake Coleridge power-supply. A specially checked integrating wattmeter was used to measure the units taken, and kilovolt-amperes were determined from readings of standardized ammeter and voltmeter The motors were all the same size, 3 h.p., but various kinds of milking-machines and auxiliaries were employed, which accounts for the difference in power demanded. Further, some consumers work methodically as against the inefficient methods of others; for instance, plant D milks the largest number of cows (90), while plant C milks less than half as many (35), but D consumes

only half as much power as C—that is, 0·56 kw., as against 1·14 kw. The difference is due to the difference in arrangement of the plants. C uses all appliances for milking and separating simultaneously, while D uses the appliances alternately. In the case of E a pump was also in service, accounting for the still higher demand.

It is probable that if more consideration were given to proper alignment of machines and shafting, and solidity of foundations, a higher efficiency would be obtained, for the tendency is to erect the plant in a lightly built shed attached to the often antiquated cow-byre, much to the detriment of the efficiency. At least one plant was encountered where the up-to-date machinery was supported on battens nailed to ordinary 3 in. by 2 in. uprights lightly bedded in soft ground. In another plant, on the other hand, the floor and walls were of solid concrete throughout—an object-lesson in efficiency and hygiene.

The results of the tests on the five plants are summarized and tabulated as under. The power-factor is calculated by dividing the observed kilowatts, or actual power taken, by the observed kilovolt-amperes, or apparent power made up of the actual power-current, combined with the idle or magnetizing current of the motors, multiplied by the actual pressure, 230 volts per phase.

Plant.	Number of Cows. (Average per Day.)	Number of Buckets used at a Time.	Kilowatts.	Amperes.	Kilovolt-amperes.	Power-factor calculated.	Units used per Year.
						Per Cent.	
A	45	3	0·695	3·2	2·21	31	..
B	40	3	0·840	3·4	2·36	35	1,244
C	35	3	1·140	3·7	2·60	43	922
D	90	6	0·560	3·0	2·07	27	675
E	65	6	1·500	3·9	2·72	55	1,919

The useful conclusions to be drawn from the table are—(*a*) The low power required; (*b*) the high value of the idle current and the consequent high value of kilovolt-ampere demand; (*c*) the power taken is very variable, and, as before stated, apparently depends much more on the efficiency of the plant and the method of use than on the actual number of cows milked.

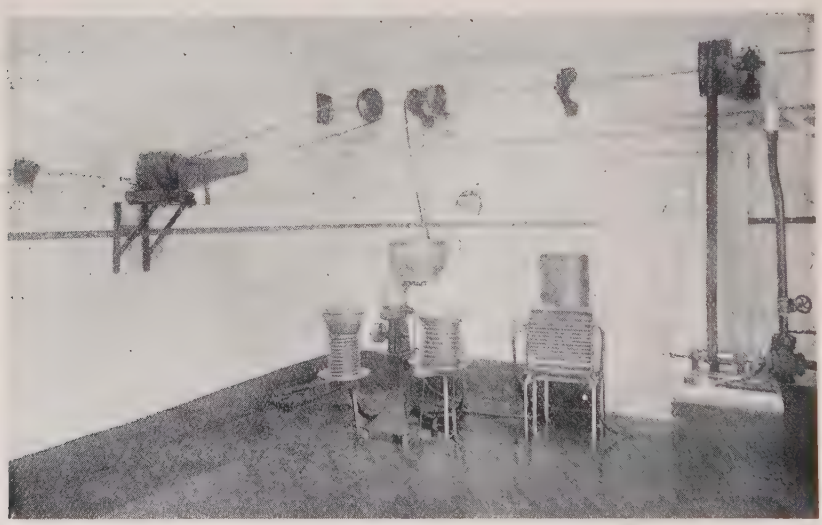
A record was kept of the consumption of four of the plants for twelve consecutive months, and the results are given in the following table, and are plotted herewith to show the demand for the various months of the year:—

Plant.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
B	102	114	108	105	99	90	110	108	96	102	111	99	1,244
C	102	138	81	115	66	54	24	3	24	105	108	102	922
D	81	96	67	65	39	18	9	12	33	87	90	78	675
E	190	186	180	162	123	87	78	87	153	198	225	200	1,919

For the supplier of power or the local authority purchasing in bulk on the maximum-demand system the curves show milking-plant load to be the ideal, inasmuch as the heaviest load occurs in summer, when no overlapping of lighting and power peaks of the main system is likely, and tapers

away to almost zero for the three worst winter-months when the general demand is highest. Further, even in summer the milking-plant load does not interfere with the industrial or day peak, owing to its being finished with before 8 a.m. and not being required again until about 5 p.m. Such load, therefore, allows an undertaking to work on a higher diversity-factor, produces a better load-factor, and tends to flatten out the daily load-curve, at the same time yielding a substantial revenue.

Additional important advantages are available from the supply of electric power in the milking-shed. Once the mains are run for driving the milking-machine the power can be used for heating water during the intervals when the milking-machine is shut down. One horse-power of energy is capable of heating up 12 gallons of water from 50° F. to the boiling-point in nine hours. This is sufficient to scald out thoroughly the whole of the milking and separating plant. The apparatus is very simple



ELECTRICALLY-DRIVEN DAIRY AT SUNNYSIDE HOSPITAL, CHRISTCHURCH.
[*Strange, photo.*

indeed, consisting only of a 10-gallon cistern with the small electric heating-element brazed into the bottom, and provided with a change-over switch which automatically connects up the heating-element when the motor is stopped and disconnects it when the motor starts up again. At a small additional charge another such cistern might be fitted in the kitchen, and another in the bathroom. These cisterns must, of course, be thoroughly and carefully lagged with a good heat-insulating material, such as felt, pumice, or asbestos composition, in order to prevent the loss of heat by radiation during the long period of heating if the above efficiency is to be attained. As compared with the usual method of scalding by carrying across a couple of kerosene-tins of fairly hot water from the kitchen—probably several chains away—spilling and cooling it on the way, until there arrives at the milking-shed some 6 gallons of only fairly hot water, the innovation of 12 gallons of electrically-heated boiling water right on the spot may work a revolution in dairying second only to that due to the introduction of the milking-machine itself. Owing to the reduction in the

labour of milking, the milking-machine has resulted in the large quantity of butterfat now produced in New Zealand. Owing to the improved cleanliness of the apparatus, the electric hot-water system may yet have as important an influence on its quality, and with the increasing amount of milk that is going into preserved- and dried-milk processes the high quality is of increasing importance.

The most effective application of electric power to the milking-machine work under New Zealand conditions will consist of a small self-contained outfit consisting of the electric motor, a vacuum-pump, a cream-separator, a small water-supply pump, and a 10-gallon hot-water cistern with the necessary switch-gear, all mounted on a compact hardwood base-plate, so that the outfit can be carried out, put down on the ground with no preparation at all, connected up, and put into service straight away. Such units are required not by the hundred but by the thousand in the dairying districts of New Zealand. When they are thus standardized the distributing authority should stock them in quantity, so that they can be put in the back of a Ford car, run out, and put into service at a couple of hours' notice.

The tests referred to in this article were carried out by Mr. H. E. Philpott, Electrical Tester, of the Lake Coleridge Electric Power Department's staff, and will be continued as occasion offers.

PHORMIUM TENAX.

THE NEW ZEALAND FIBRE INDUSTRY.

ESMOND H. ATKINSON, Biological Laboratory, Wellington.

V. GRADING, MARKETS, AND USES.

GRADING.

It has been already pointed out how unreliable was the quality of the fibre exported in the early days of the industry, and what the various considerations were that led to the passing in 1901 of the Flax Grading and Export Act, which provided for the compulsory grading by Government experts of all fibre prior to its leaving the country. The original regulations have been considerably modified from time to time, and it is unnecessary to quote them here, what follows being an account of the present-day procedure in grading phormium-fibre, or "hemp" as it is termed in connection with the grading-system.

Bales for export must conform approximately to the following dimensions and weights: Hemp—length 4 ft., width 2 ft., weight not exceeding 4 cwt. Tow—length 4 ft., width 2 ft., depth 3 ft., weight not exceeding $2\frac{3}{4}$ cwt. Stripper-slips—length 4 ft., width 2 ft., depth 3 ft., weight not exceeding $2\frac{3}{4}$ cwt.

Before it leaves the mill each bale must have placed in it a piece of wire 2 ft. long with a tin tag at its inner end (in the middle of the bale) and a leather or canvas tag at its outer end (hanging outside the bale), each tag bearing the registered brand of the mill and the number of the bale (see Figs. 1, 2, and 3).

The following are the standards on which the grades of phormium ("hemp") are determined: A grade (superior), 90–100 points; B grade (fine), 80–89; C grade (good-fair), 70–79; DD grade (high-fair), 65–69; D grade (fair), 60–64; E grade (common), 50–59; F grade (rejected), under 50. The maximum points for allotment are as follows: For stripping, 25; scutching, 25; colour, 25; strength, 25: total, 100.

Tow is divided into three grades: No. 1 grade, 80–100 points; No. 2, 60–79; No. 3, 40–59. No grader's certificate is issued in respect to any tow scoring less than 40 points. Stripper-slips are divided into two grades—No. 1 and No. 2. Both with tow and stripper-slips the grader's certificate states only the grade awarded, the points scored being only for the grader's guidance.

At the grading-store the grade of each parcel of hemp, tow, or stripper-slips submitted for grading is determined by the grader upon opening at least 10 per cent. of the bales, and such further number as he deems necessary, and also, in the case of hemp, upon drawing hanks from as many additional bales as he considers necessary. It is also provided that no grader's certificate shall be issued in respect to any fibre which in the grader's opinion is unfit for manufacture or for any other trade purpose.

When grading is completed the line is repacked, and the outer tag is stamped according to the grade awarded. A report is then forwarded to the miller on every line, so that he may be able to note and remedy any defects. A certificate signed by the grader, giving particulars of the number of bales graded, the grade awarded, and, in the case of hemp, the number of points, is sent to the owner of the fibre or his agent. It is on these certificates that the fibre is sold to overseas buyers.

MARKETS, USES, AND RIVAL FIBRES.

The largest buyers of phormium-fibre outside New Zealand (taking the average of the figures for the last six years) are the United Kingdom, United States of America, Australia, and Canada, in the order given, the quantities credited to other countries being almost negligible in comparison. It is known, however, that—in pre-war days, at any rate—a considerable quantity of the phormium-fibre imported into the United Kingdom ultimately found its way to the Continent of Europe. In addition to that exported, a certain quantity of phormium is used in rope and twine works in the Dominion.

The vegetable textile fibres of the world may be roughly classified, according to their origin, character, and use, into three groups: (1) cottons; (2) soft fibres, including flax (*Linum*), hemp, (*Cannabis*), jute (*Corchorus*), and ramie (*Bochmeria*); (3) hard fibres, including manila (*Musa*), sisal (*Agave*), and phormium, the latter being the only important hard-fibre plant of the temperate zones. If phormium-fibre could be placed on the market equal in softness, silkiness, and whiteness to the Maori product it would doubtless enter into competition with some of the soft fibres, but at present it is known commercially only as a hard fibre, its chief rivals being manila and sisal. All three fibres are used for making binder-twine, phormium being considered by many authorities as the best of all materials for this purpose. Complaints have been made that it is liable to deteriorate in strength to a greater degree than either manila or sisal, but as a rule the durability of binder-twine is

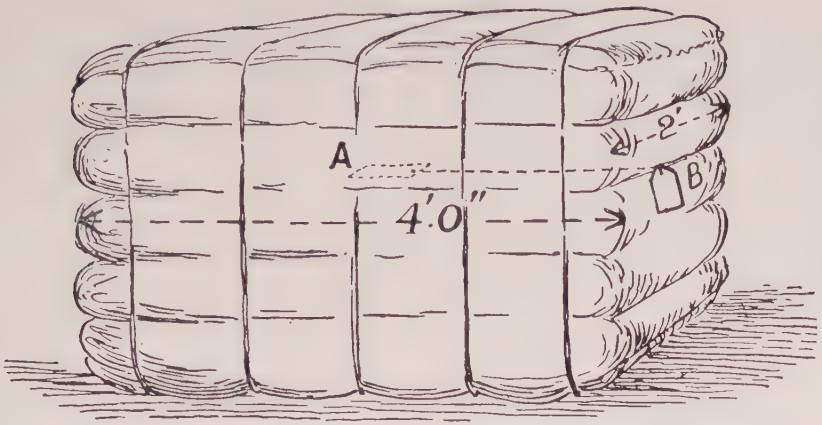


FIG. 1. BALE OF PHORMIUM FOR EXPORT, SHOWING TAGS.

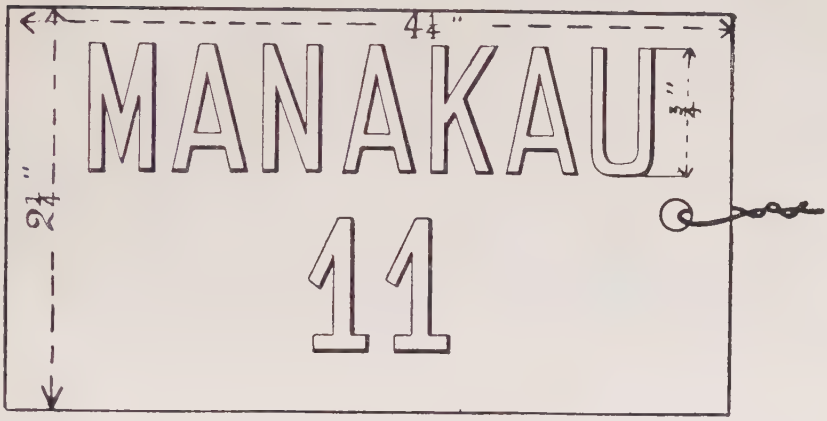


FIG. 2. SPECIMEN OF AN INNER TAG.

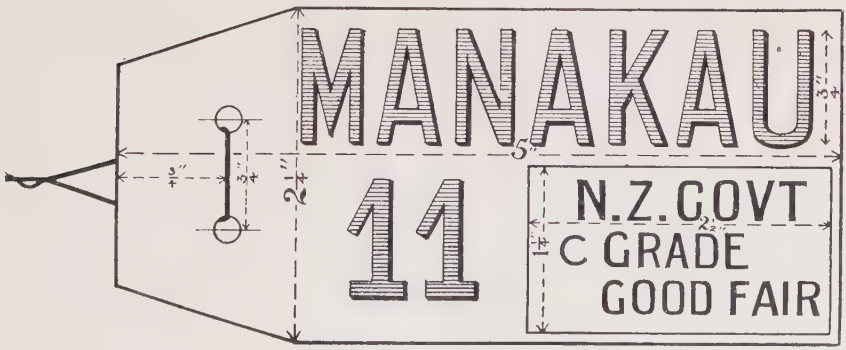


FIG. 3. AN OUTER TAG.

not a matter of the first importance. In Canada it is said to be preferred to the other two for this purpose owing to its stray fibres being more easily digested in the chaff, &c., by young stock. As a material for ropemaking phormium is used both alone and in combination with manila, to which it bears so close a resemblance in appearance that expert knowledge is required to distinguish readily between the two fibres. Phormium is flexible and somewhat elastic, and stands salt water better than any other commercial hard fibre except manila. The comparative strengths of manila and phormium are given by Holmes from tests made by Messrs. Frost Bros., London, as in the ratio of 245 to 143, that of sisal being 128. The grade of phormium used is not stated.

Phormium tow is used for the manufacture of rough cordage, as a binding-material in certain kinds of plaster, for stuffing mattresses, and for many other purposes. As a papermaking material tow has

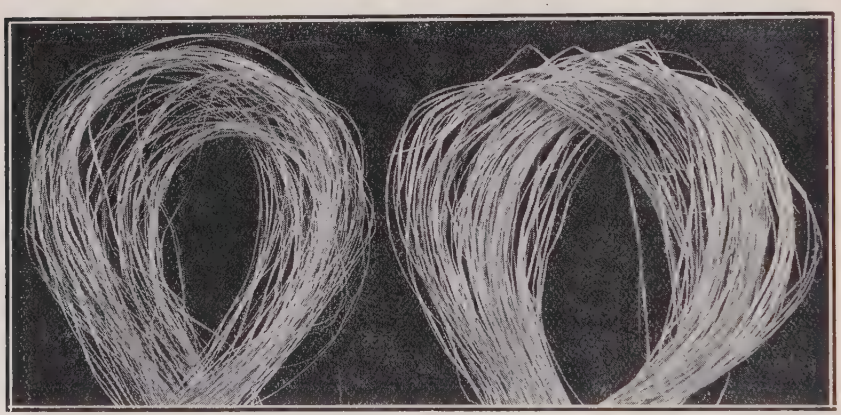


FIG. 1. ON LEFT, MAORI HAND-DRESSED PHORMIUM-FIBRE, SHOWING EXTRA FINENESS AND PLIABILITY; ON RIGHT, ORDINARY MACHINE-DRESSED SAMPLE.

great possibilities, and is manufactured in New Zealand into wrapping-papers, which are very strong, though not equal in appearance to wood-pulp paper.

Use by the Maoris.

It may not be out of place to give here a brief summary of the uses to which phormium was put by the Maoris in pre-European days. As a fibre-plant it was employed, broadly speaking, in two distinct ways, as follows:—

(1.) The leaves were used just as they were obtained from the plant, with no other preparation than that of splitting them into strips of the required width for the larger fishing-nets (which were very often of great size and strength), for plaiting into ropes for various purposes, and for making baskets, rough mats, &c., of a great many different kinds. Colenso records that the Maoris of southern districts made sandals of the split leaves for wearing on the snow when they ascended the mountains.

(2.) The fibre, obtained from the leaves in the manner already described, was twisted, plaited, or woven in an almost endless number of ways, and made into clothing of all kinds, from that used every day

to the most elaborate dress mats of the chiefs. The dressed fibre was also largely used for smaller ropes and cords, fishing-lines, smaller fishing-nets, and innumerable other purposes. In many cases the dressed and undressed fibre was used in combination. The fibre took very successfully the various dyes used by the Maoris, which were chiefly obtained from the bark of certain trees and from earths.

Apart from its great primary use as a fibre-plant, phormium served the Maoris in several minor ways. The dead flower-stalks, on account of their extreme lightness, were tied in bundles and made into rafts, particularly by the Morioris in the Chatham Islands, where there were no large trees suitable for canoes. When the flint and steel were introduced by the first Europeans the dried stalks came to be used as tinder. The long fibrous roots were woven into fish-traps, according to Colenso, who also records that the shorter leaves were used as splints, while the white butts were roasted, and after being pounded up were applied as poultices in certain diseases. Both the gum found in the bases of the leaves and the abundant nectar secreted by the flowers were collected and eaten. The bitter principle of phormium has decided medicinal properties, and was considered tonic by Church ("Transactions of the New Zealand Institute," Vol. vi, p. 260). A decoction of the root was used by the Maoris as a strong purgative, and also as an anthelmintic.

Utilization of By-products.

Although a certain proportion of the more fibrous parts of the waste from the stripping process is now saved and marketed as "stripper-slips," there still remains a great deal which up to the present has been little used. A complete analysis of this refuse was made in 1900 by Mr. B. C. Aston, Chemist to the Department of Agriculture, and a partial one in 1904, the latter showing it to consist of 60 per cent. of water, and 40 per cent. of dry matter containing 6·34 per cent. of ash, 0·74 per cent. of nitrogen equal to ammonia, 0·15 per cent. of phosphoric acid, and 2·10 per cent. of potash. The opinion was expressed that this would make a good fertilizer if it were well rotted and easily obtainable. Experiments were accordingly carried out with potatoes, the results in the case of a plot dressed with 30 tons per acre of waste comparing very favourably with the best results obtained with artificially dressed plots. In another trial with mangolds the refuse by itself did not make much showing, but in combination with superphosphate took second place in a trial with twenty-two different mixtures of artificial fertilizers. One great advantage possessed by phormium-refuse over such a fertilizer as stable manure is its freedom from weed-seeds.

Phormium Honey.

In those areas where phormium is abundant it is not without importance to the beekeeper. The honey is very thick in consistency and dark in colour, and therefore is not a good commercial table honey, though it might be used in manufactures. It cannot be extracted in the usual way, but has to be melted out. In phormium districts the honey is collected in large quantities by the bees, and is of real use in supplying winter feed for them, leaving the higher-grade honey collected from other plants, such as white clover, &c., available for marketing.

(To be continued.)

FUNGOID DISEASES ATTACKING LEMONS.

SPRAYING-TESTS IN AUCKLAND GROVES.

THE tests here dealt with were carried out under the supervision of Mr. J. W. Collard, Orchard Instructor, in the citrus-orchard belonging to Mr. W. Winstone, sen., Mount Albert, Auckland, who kindly placed the trees at the disposal of the Horticulture Division for the purpose. By the courtesy of Messrs. H. A. Buscomb and M. Pender similar tests were also conducted in their orchards at Henderson, where practically the same results were obtained. The experiments, which in the first place were intended to cover the 1918–19 season, were eventually extended over the 1920 season, owing to adverse weather conditions experienced in the winter of 1919.

Spraying was carried out with lime-sulphur compound and bordeaux mixture with the object of determining the following points: (1) The spray giving the best results; (2) the best and most economical period to apply same; (3) the strength at which to be applied for control of verrucosis, grey scab, and *Pythiacystis citropthora*. The results of the tests are set out in the notes which follow.

Lime-sulphur.

Strength 1–30: Will hold diseases named fairly well in check, if intelligently applied. Two sprayings in the season are ample—namely, after the blossom-petals have fallen from the main flowering and in the autumn respectively. Weakly trees on the lighter soils will not stand this spray, and well-grown healthy trees were defoliated considerably with three applications during the season.

1–35: Results equal to 1–30. No defoliation with two sprayings in season, but slight scorching with four applications.

1–40: Almost equal to 1–35. No defoliation, using four sprays.

1–50: Considerable infection always in evidence on trees sprayed at this strength. May be dispensed with as of no value for control.

1–65: Infection bad towards end of season. Should be dispensed with for citrus.

1–30 followed by 1–40 (when main-crop flowers and autumn flowers, respectively, have fallen): Only very slight infection noticeable at any period on these trees. Very slight defoliation after 1–30 application.

Bordeaux.

Formula 4–4–40: An absolute control of the three diseases was maintained with two applications of this formula, after the falling of blossoms in the main crop and autumn respectively. Scorching of foliage hardly noticeable, but slight discoloration of fruit and wood.

4–4–40 followed by 5–4–40: Same periods as above, and results better than any lime-sulphur-treated trees, but not so good as two applications of 4–4–40 at the same times.

6–4–40: This was not applied at petal-falling period in these tests, and therefore a comparison cannot be made in relative value to 4–4–40

used then. As, however, considerable scorching results from its use at any period it is not advisable to use this formula unless a commencement is being made to overtake bad infection in a very dirty grove.

CONCLUSIONS.

Bordeaux.—As a spray to combat and control fungus diseases attacking lemons bordeaux still maintains the first place. The 4–4–40 formula used at the right periods—two applications per annum—will effectively control these diseases. There is no need to use this compound at a greater strength unless, as stated above, bad infection has to be first combated; and in such cases where 5–5–40 and 6–4–40 are used defoliation must result. Bordeaux used to excess, however, invariably leaves its mark upon the tree, and often upon the fruit. The wood gradually becomes scorched, and in consequence the sap-cells are to some extent injured; but without this we are, so far, unable to effect a control of fungus.

Lime-sulphur.—Without doubt, where control of fungus disease has resulted from its use the fruit is of a very much better appearance than that from bordeaux-sprayed trees. There is also very much less damage to wood by scorching—even in using 1–30 lime-sulphur—than with 4–4–40 bordeaux. However, the control with lime-sulphur, 1–30, is not so entirely effective as with bordeaux, 4–4–40.

Summary.—The tests have proved beyond doubt that the control of verrucosis, grey scab, and *Pythiacystis citropthora* is best achieved by thorough and methodical applications of bordeaux, 4–4–40, using at least two sprayings in the season, namely: (1) When the petals have fallen from the main blossoming, (2) when the petals have fallen from the autumn blossoming. The greatest drawback to the use of lime-sulphur is its failure to effectively control fungoid disease without causing considerable defoliation.

—*Horticulture Division.*

Californian-thistle Control.—Mr. A. W. Barnett, of Morven, South Canterbury, writes stating that he has cleared a number of patches of Californian thistle on his farm by the following method: With a butcher's knife a cone-shaped hole is made in the ground, 3 in. or 4 in. deep, with the apex where the thistle-root lies. Three or four handfuls of salt are then placed in the hole, and the latter filled with water. The watering is repeated after a few moments. The operation should be carried out as soon as a plant appears.

Topping and Trimming Pinus insignis for Shelter.—The best method to follow for a pine hedge is to commence trimming when the trees are young, and, say, about 5 ft. or 6 ft. in height, as a close, thick hedge can then be gradually formed. A suitable permanent height for the hedge is approximately 15 ft. August and September are suitable months for doing this work. A single row of *Pinus insignis* will, if annually topped and trimmed, form a close, thick hedge about 6 ft. in width. Trees over ten or twelve years old are usually too large for safe topping, the operation being liable to cause them to die off.

TEST FOR CONTROL OF LEAF-HOPPER ON APPLE-TREES.

W. C. HYDE, Orchard Instructor, Nelson.

A CO-OPERATIVE spraying experiment for the control of leaf-hopper (*Pochasia australis*) on apple-trees was conducted during the past season (1920–21) in the orchard of Mr. O. H. Taplin, Wakatu. The test was carried out over an area of about 4 acres, most of the trees being some nine or ten years old.

The first application of spray for the purpose of the experiment was made on 29th October, when the apples had set. It consisted of lime-sulphur, 1–100, with 3 lb. arsenate of lead and 1 pint Black-leaf 40. At the time leaf-hopper larvæ were just emerging, and were found feeding along the midrib on the under-side of apple-leaves. Oval, green, semi-transparent eggs were occasionally found in such places; they appeared to be eggs of the leaf-hopper.

On 22nd November an area of about an acre of Sturmer and Jonathan trees received a further application of the above spray. Early in December hopper became fairly bad in the orchard, except on the section sprayed on 22nd November, which was practically clean. However, two subsequent sprays, applied on 17th December and 27th January, quickly checked it, and there were very few signs of the pest on this test plot for the rest of the season. On the adjoining hawthorn hedge, and on sections of the orchard receiving ordinary spraying, the infestation of leaf-hopper was very bad—particularly so on the hedge.

This orchard is very sheltered and has a hawthorn hedge practically all round it, and therefore is very suitable for such a test as this. Those who have inspected these experiments agree that it appears this hopper can be kept well in hand by the addition of Blackleaf 40 to two or three of the standard spring sprays—commencing, say, with the calyx-spray—even when the environment is adverse. The section of this orchard receiving ordinary spraying — which included lime-sulphur, 1–80, at the fruit-set period — showed little or no control over the insect.

Soldiers' Quarters at Ruakura. — Beautifying the grounds of the returned-soldier training-quarters at the Ruakura Farm of Instruction is being carried out on a plan including drives, walks, lawns, trees, and shrubs. On 14th July a very pleasing gathering of an Arbor Day character was held on the grounds in connection with the scheme. After some appropriate addresses the first tree was planted by Lieut.-Colonel E. H. Northcroft, who was Director of Education in the New Zealand Expeditionary Force in England. Trees were also planted in central positions by the Mayor of Hamilton, and representatives of the local Repatriation Board and Returned Soldiers' Association. Each soldier trainee also planted a shrub or tree along the drive-borders. It is intended later on to erect a flagstaff in the centre of the grounds.

FARMERS' SCHOOL AT RUAKURA.

THE third annual school for farmers was held at the Ruakura Farm of Instruction between 18th and 30th July. This year the school has been directly organized and controlled by the Department of Agriculture, the Auckland Education Board co-operating. Owing to the largely increased number of entries—some 150—the school was divided into two sessions, each of a week's duration, the course being practically identical in each. In addition to the farmers the school was attended by returned-soldier trainees and cadets in residence at Ruakura, the benefit of the instruction being thus largely extended. The visiting farmers were quartered in various farm buildings, and all catering was also done on the farm. Naturally the great majority of the farmers were from North Island districts, the South Island being represented by a few entries only.

The organization work in connection with the school and its courses was carried out by Mr. T. H. Patterson, Instructor in Agriculture for the Auckland District, while Mr. A. W. Green, Manager of the Ruakura Farm, undertook the general management, seconded by Mrs. Green on the household side. The school

GROUP OF FARMERS, VISITORS, AND STAFF AT THE FORMAL OPENING OF THE FIRST WEEK'S SCHOOL.

course was divided into three sections — (1) general agriculture, (2) dairying and live-stock, and (3) horticulture and beekeeping. Lectures were given in the lecture-hall of the soldiers' training-quarters, or outside at various points on the farm in the case of demonstrations, a feature of the latter side of the course being the farm-inspection rounds conducted by Mr. Green. The time-table began at 8.30 a.m. and continued, with intervals, until 9.30 p.m.

Lectures and demonstrations comprised the following: The feeding of dairy cows (A. H. Cockayne, Agricultural Instruction Service); field instruction; manures and manuring; liming; Nauru phosphate (T. W. Patterson, Instructor in Agriculture); agricultural education (J. P. Kalaugher, Supervisor of Manual and Technical Branch, Auckland Education Board); principles of grassland establishment and management (E. B. Levy, Biological Laboratory); utilization of fodder crops (R. P. Connell); farm economics; drainage (F. R. Callaghan, Agricultural Instructor*); soil fertility and cultivation; forage crops (C. W. Smallfield, Assistant Instructor in Agriculture); farm horses (J. Lyons, District Superintendent, Live-stock Division); the cow in health and disease (S. Burton,

* Auckland Education Board.

Veterinarian); bacteria in relation to farming (R. Waters, Biological Laboratory); handling milk and cream on the farm (G. M. Valentine, Dairy Instructor); cream-grading (W. Dempster, Dairy Instructor); poultry-breeding (F. C. Brown, Chief Poultry Instructor); dairy breeds and breeding (A. E. Missen and H. E. B. Watson); ensilage (W. Dibble, Fields Instructor); insect pests of live-stock (D. Miller, Biological Laboratory); orchard practice (L. Paynter, Orchard Instructor); maize and maize-growing (P. Gallagher, Agricultural Instructor*); milk-testing (W. Hudson, Agricultural Instructor*); forestry for farmers (P. M. Page, State Forest Service); oil-engines (H. Toombs, Instructor*). Mr. A. W. Green's "farm-inspection" subjects included pastures, swamp-land reclamation calf-feeding, milking-shed and dairy, Milking Shorthorns, and pigs. Open-air horticultural, beekeeping, and poultry demonstrations or talks were also given by Messrs. T. B. Roach, A. B. Trythall, and H. A. Kitto, in charge of the respective branches on the farm. Other practical demonstrations included one on fencing and gate-hanging by Mr. W. Honeybun, Farm Overseer, also one on manure-mixing.

A valuable adjunct to the course was the biograph, enabling the illustration of lectures, &c., with moving and still pictures. Ruakura being now connected with the Horahora hydro-electric supply, current for a first-class display was available. Operating was by the Department's photographer, Mr. S. B. Taylor, and (in the second week) Mr. M. H. Robinson, assistant photographer.

Large gatherings, including prominent local people, took place at the opening function of each of the sessions. The formal opening of the first school was declared by Mr. F. S. Pope, Assistant Director-General of the Department, while Mr. J. L. Bruce, Superintendent of Experimental Farms, performed the same duty on the second occasion. The social side of the schools was not neglected, a special entertainment being held each week in the lecture-hall, while the biograph also provided some interesting and useful recreation apart from strictly agricultural subjects. The weather was favourable generally, especially during the second period. Altogether the Ruakura Farmers' School of 1921 can be recorded as a pronounced success, and beneficial practical results cannot fail to follow on many farms.

Full general publicity was given to the school in the local Press. As regards the lectures, it is intended to publish several of these in the *Journal*. The first article of this issue, "The Feeding of Dairy Cows," is substantially the lecture on that subject delivered by Mr. A. H. Cockayne, who, it may be mentioned, now has a general supervision of the agricultural instruction work of the Department.

* Auckland Education Board.

Barberry as a Noxious Weed.—The common barberry (*Berberis vulgaris*) has been added to the Third Schedule of the Noxious Weeds Act, comprising plants which may be declared noxious weeds at the option of the local authority. This action was taken largely on representations from Taranaki, in parts of which barberry is spreading from neglected hedges and becoming a nuisance. The scheduling also had the recommendation of the Board of Agriculture.

The Fencing Act and Wire.—At the last meeting of the Board of Agriculture a suggestion was placed before it to have the Fencing Act amended to permit of the use of a lighter wire than is specified in the construction of a "sufficient" fence. The proposal received full consideration, but the Board recorded the opinion that further lengthy tests of the lighter wire are required to establish the claims made for it before any amendment is made in the Act.

Errata.—The second paragraph of page 24 in last month's *Journal* ("Improvement of Poor Pasture: The Wallaceville Experiments") should read as follows: "In considering these returns it must not be forgotten that the slagged paddock (No. 1) was top-dressed as recently as February, 1919, and the high results may be due to this fact. The carrying-capacity of paddocks 3 and 4, which have not been artificially top-dressed since August, 1915, compares very favourably with the slagged plot."

It may be also mentioned that these experiments are being continued.

WORK FOR THE COMING MONTH.

THE ORCHARD.

FIREBLIGHT.

ALTHOUGH fireblight has been practically dormant for some time past, fruitgrowers within the affected area are aware from past experience that it only requires the warmth of spring to galvanize it into activity once more, and are naturally deeply concerned with respect to possible developments during the blossoming-period. In the meantime everything depends on the complete eradication of all cankerous infections in which bacterial activity may be renewed when suitable climatic conditions obtain, regardless of the host-plant on which they may be found. This extremely important work has been claiming the active attention of the officers of the Horticulture Division, the central fireblight committee, and fruitgrowers alike practically throughout the season. Much useful work in this way has been done with regard to affected fruit-trees, but, however complete this might be, it will be of little value unless the hawthorn-hedge question is also satisfactorily settled. How this will end is not yet quite clear.

As a result of the recent legislation hawthorn has been declared a noxious weed by the Waitemata County Council in the district under its jurisdiction. This has considerably improved the position as far as the Henderson fruitgrowing areas are concerned, where a lot of valuable work in the grubbing-out of hawthorn has already been done. At date of writing, however, there are several local bodies within the county which, although possibly intending to follow the County Council's lead, still have to take the necessary steps before hawthorn can be dealt with under the Act throughout the county. Although the complete removal of hawthorn is highly desirable from the fruitgrowers' point of view, cutting back to prevent blossoming is the next best step, and it is to be hoped that all hawthorn-owners within the county will at least adopt this course well before blossoming commences, and thereby do something towards helping the fruitgrower in his fight against this serious menace to his industry.

In connection with the fireblight campaign the Orchard Instructors at present stationed in the Auckland Province have been appointed Inspectors under the Noxious Weeds Act.

FRUIT EXPORTS.

Mr. G. Stratford, Orchard Instructor, who, it will be remembered, while on a private visit to England, was retained by the Government to investigate and report upon the fruit-marketing conditions in the United Kingdom, also on the condition of our fruit arriving in England during the past season, together with its standing in the trade as compared with that imported from other sources, has made to date of writing three very interesting reports. The first two covered the period of his investigations prior to the arrival of the "Hororata" shipment, and have reference to the respective merits of the various marketing-centres, sales by private treaty as against the auction system, the standing of and services likely to be rendered to New Zealand shippers by certain of the leading fruit-merchants in the different centres, the opinion in which New Zealand fruit is held by the trade, &c. The third report has to do with the condition, distribution, and sale of the "Hororata" shipment.

Although the reports referred to may not be published in detail until after the return of Mr. Stratford, which is expected early next month, their general tone suggests that a large amount of very valuable information will be available in ample time to assist those concerned in connection with the next export season. In the meantime it is satisfactory to note that New Zealand apples are highly appreciated in England, and that the packing and general appearance of the package is equal to anything arriving on that market. In condition much of the "Hororata's" fruit was poor and wasty. This condition applied to the early varieties only; Dunn's, Jonathans, and King Davids all arriving in good order. The contributing

factors with respect to the condition of the early varieties are well known and avoidable, consequently a much greater measure of success, even with the varieties in question, may be looked for in the future.

—J. A. Campbell, Director of the Horticulture Division.

AUCKLAND.

Pruning completed, attention should be turned to the all-important work of spraying. Stone-fruits must receive the first attention, an application of bordeaux, 8–6–40, for the control of fungoid diseases generally, being made just as the buds commence to burst and show pink. Where not already applied to pip-fruit trees sprayings with red oil should be undertaken, at 1–12 for apples and 1–14 for pears, just at the very first stages of bud-movement, for control of biting-insects.

If black-spot has been at all in evidence in the orchard the following programme is recommended as a control measure: Bordeaux, 8–6–40; at bud-movement (showing pink); 6–4–40 when cluster-buds are expanded and showing colour; and 3–4–40 at "petals fallen" period. On varieties which are liable to scorch applications of lime-sulphur may be substituted as follows: For apples—At 1–10 when buds are bursting; at 1–25–30 when buds show colour; and at 1–100–120 when petals have fallen. For pears—At 1–10 when buds are bursting; at 1–15–20 when buds show colour; and at 1–80–100 when petals have fallen from blossoming. These formulas are based on the 33° Beaume standard. The value of testing the specific gravity of commercial lime-sulphur is underestimated; the practice is indispensable owing to the presence of a number of unreliable brands of this compound on the market.

On citrus-fruits spray as soon as possible with red oil, 1–40, for control of scales and thrip. When the petals have fallen from the main spring blossoming, spray thoroughly with bordeaux, 4–4–40, for control of verrucosis, grey scab, &c. Infection from brown-rot has been rather prevalent in a number of Auckland orchards, and as a means of combating this trouble growers should remove from the trees all the lower branches which hang to the ground, leaving a good 6 in. clearance. This will allow entry of light and air, and thus prevent the existence of humid conditions, which are so conducive to the rapid development of this fungus disease. Pulverized sulphate of iron, at rate of 4 lb. to 6 lb. per full-grown tree, distributed beneath the spread of the tree and lightly hoed in, is also recommended as a deterrent in the early spring.

Continue applications of bordeaux, 3–4–40, on strawberries and loganberries, keeping them well covered with the spray.

Cultivation can be proceeded with as soon as spraying operations will allow (see last month's notes). Growers will be relieved to find that the price of manures generally has declined somewhat. It is advisable to get the fertilizers applied at the earliest opportunity, if this has not already been done before the first ploughing was undertaken. Great benefit has accrued to orchards planted on the Auckland gum lands through the liberal application of carbonate of lime (ground limestone). The application of 15 cwt. to 20 cwt. per acre is recommended, as this class of land shows a deficiency of this element.

Grafting must be completed this month without fail.

Fireblight: The warning issued in last month's notes can only be repeated. Get busy and get the hawthorn out by the root.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY

All dormant-period work should be completed as soon as possible, and the orchard put in good order for the coming season. What are probably the most important sprayings of the whole year must be attended to during the coming month. Each variety should be treated as it attains the correct stage, the time of application being of equal importance to the compound used.

Stone-fruit trees which have not received the spring application of bordeaux, 8–6–40, should be attended to as the most advanced buds show pink. If the trees have become well advanced in colour of bud before this could be done, use 3–4–40 bordeaux. This spraying is used as a precaution against leaf-curl, bladder-plum, shot-hole, and rust. For brown-rot it is advisable to apply lime-sulphur, 1–120, at fruit-set period. Black aphis may be controlled with Black Leaf 40, ½ pint to 50 gallons, to which has been added 1½ lb. soap as an adhesive.

For the treatment of black-spot bordeaux is the preventive to be relied on. Though there are certain varieties which russet badly if bordeaux is applied too

late, all varieties will benefit by an application if made before pink cluster, though in some instances lime-sulphur is preferable, owing to the necessity of controlling powdery mildew. For working convenience apples and pears may be divided into classes and treated as follows: (1.) Apples and pears not subject to russet—early bud-movement to green tip, oil, 1–17; open cluster but not showing pink, bordeaux, 6–4–50; petal-fall, bordeaux, 3–4–50. (2.) Apples and pears inclined to russet—early bud-movement to green tip, oil, 1–17; open cluster but not showing pink, bordeaux, 6–4–50; petal-fall, lime-sulphur, 1–50. (3.) Varieties russeting badly and also subject to powdery mildew — early bud-movement to green tip, oil, 1–17; open cluster but not showing pink, lime-sulphur, 1–25; petal-fall, lime-sulphur, 1–50, plus 3 lb. of atomic sulphur.

It will be noted that for the various apples and pears, regardless of liability to russet, an application of oil is advised at bud-movement even as late as green tip. At this period a maximum of efficiency in the control of the various insect pests is assured, while the general effect of the oil on the eggs of red mite is such that hatching is retarded considerably, and the trees are safeguarded against the attack of early insects during the flowering-period. This latter pest proved difficult to control during the past season, a condition no doubt accounted for in some measure by the sequence of dry seasons. Successful control depends to a great extent on promptly killing the first brood of insects as they emerge from the eggs. Hatching varies a good deal with the locality and season. A close watch should be kept, and lime-sulphur applied when the mites are first hatching. The strength used will depend on the state of the trees: open cluster, 1–25; pink cluster, 1–40; petal-fall, 1–50; calyx, 1–80; and later, 1–100.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

Of all orchard operations this month spraying stands first. These early applications are important, and the omission of one or both of these was responsible for the majority of spotted crops last year. In the warmer showery days of spring are found the conditions in which black-spot flourishes. Pear and apple trees can be protected from that and other fungi by careful and thorough spraying. Pear-trees, while still dormant, should receive an application of bordeaux, 8–6–40, and should they be affected with pear-mite or scale insects, this should be followed by red oil, 1–12 or 1–15, according to the stage of growth of the tree. When the flower-buds commence to open bordeaux should be again applied, the formula used being 6–4–50. For apple-trees lime-sulphur is preferred to bordeaux as a fungicide in this district. Just before the trees start into growth an application at a strength of 1–10 is recommended, but if the buds are breaking this can be further diluted to 1-20. Should it be necessary to spray the trees with red oil this should be applied at a strength of 1–15 or 1–20, the latter being used if growth has started. For black scale on lemon-trees apply red oil at a strength of 1–40.

Pruning should be completed without delay, leaving the citrus-trees to the last. Do not omit to dress the larger cuts with a paint or tar.

As soon as the soil is sufficiently dry the orchard should be ploughed. Where necessary, a dressing of lime or manure should be given and the ground well harrowed down. Trees kept in good heart this way are more easily kept clean and easier to manage in every way.

Grafting may be commenced as soon as the trees start into growth, usually about the end of September.

In reference to the depredations of hares, Mr. H. E. Stephens, Stoke, has obtained excellent results by loosely tying a sheet of paper round the trunk of the tree, this apparently acting as a scare. The glazed paper used for illustrations by the 'weeklies'" will last the whole season, half a sheet per tree being sufficient.

—W. C. Hyde, Orchard Instructor, Nelson.

NELSON CENTRAL.

Early September should see the pruning completed and grafting attended to. Where the land has been ploughed and left in the rough a disking or harrowing, as the conditions of land and weather warrant, should be given to facilitate the work of spraying. It is now that the orchardist must decide on a course of action for the control and prevention of insect pests and fungus diseases in his orchard, bearing in mind the degree of infection, previous treatment, &c., of the particular trees needing attention.

Woolly aphis and red mite are the principal insect pests in this locality at present, and where young non-bearing trees are infected every effort should be made to eradicate the infection during the dormant period, using an oil spray at from 1–10 to 1–12 according to the weather conditions prevailing; dry, bright conditions are the best. If this is thoroughly done very little trouble will be experienced during the growing season. Bearing orchards are the better for an oil spray also, even though summer spraying is to be depended on for the control of these pests, as the oil has a softening effect on the bark; where lime-sulphur is in constant use the bark becomes hard and dry.

The great consideration at this period is the prevention of black-spot. It has become more apparent of recent years that prevention is the effective method of combating this disease, and most growers are quite convinced of the necessity of attacking it as soon as growth commences. Lime-sulphur is becoming increasingly popular, and if followed up consistently throughout the season will give satisfactory results. Following is the spraying recommended for apples, using lime-sulphur of 33° test: Green-tip stage, 1–15 to 1–25; pink stage, 1–35 to 1–50; and from petal-fall to fruit-set, 1–60 to 1–80—in each case according to the degree of development of the tree. Each variety must be dealt with as the correct stage is reached. Varieties particularly susceptible to the disease and situated in unfavourable situations can be sprayed with bordeaux, 4–3–40, at green tip to open cluster; and 3–4–40 or 2–3–40 when showing pink, having regard to the tenderness of the variety and its liability to russeting. Where these conditions render it advisable lime-sulphur should be used at the pink stage and at subsequent sprayings. Pears can be sprayed with bordeaux at the same periods of development and at the same strengths; a little russeting does not harm them.

Green crops should be ploughed under before the ground becomes hard and dry, and the land then disked or harrowed to conserve the moisture and thoroughly cover up the crops. —*J. H. Thorp, Orchard Instructor, Mapua.*

MOTUEKA.

Cultivation should be attended to now. Where manure is being applied it should be turned in with the spring ploughing. Any necessary grafting should be put in hand as the sap begins to move freely. Stored fruit should be carefully watched for deterioration as the season advances, and marketed accordingly. Steps should be taken to ensure a supply of fruit-cases, wrapping-paper, nails, and other requisites for the coming season. It is not the best method to leave these details until the commodities are actually required.

With the general bud-movement of the higher forms of plant-life come also the activities of fungus growth. The up-to-date orchardist will now be commencing the most busy part of the spraying season. Exactly how busy this is to be will be determined by several factors, chief among which are weather conditions, and the number of varieties of fruit contained within the orchard. Adverse weather conditions following the application of a spray for prevention of fungus diseases, mainly black-spot, necessitates another application, for it is essential that the trees be kept well covered with a suitable fungicide at this period of the year, when the early spring spores are most active, if the orchardist would have a clean crop. Therefore, irrespective of adverse conditions, these most important sprayings should be carried out. Likewise, a number of varieties means several different applications, as each variety reaches the stage of growth at which most effective results are to be obtained at a different time.

Spraying for the month is recommended as follows: Stone-fruits—Bordeaux, 6–4–50, to be applied before the blossoms open. Apples—Bordeaux, 6–4–50, at bud-movement; lime-sulphur, 1–30, at pink stage. For those varieties subject to bad russeting, particularly Dunn's, lime-sulphur, 1–10, may be used at the early stage instead of bordeaux. Pears—Bordeaux, 8–6–40, at bud-movement; bordeaux, 6–4–50, at pink stage. As different varieties reach the stages indicated at different periods, even if the difference is only a matter of days, it is essential that the varieties of each fruit be treated separately and sprayed accordingly. —*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Pruning: This work should be completed. Gather and burn all prunings and remnants of crops, and thus eliminate one source of disease-infection.

Cultivation: The spring ploughing should be commenced as soon as the soil is in a suitable condition. Break down the soil before it dries out and becomes hard.

Manuring: Growers who intend using quick-acting fertilizers this season should make the first application about the beginning of September. An annual light dressing of from 4 cwt. to 5 cwt. per acre of superphosphate and blood-and-bone in equal proportions should be sufficient. Wood-ashes saved from the burning of prunings and rubbish should be added to the mixture. Do not apply the whole of the fertilizer at once, but rather make two applications, the second being made about the time the fruit sets. Spread the fertilizer through the orchard and harrow it in right away, avoiding the mistake that is so often made of manuring the ground immediately around the trunks of the trees.

Cover-crops: Green manures should be ploughed in as soon as the ground is dry enough to permit of it being worked. If the crop is a tall one attach a chain to the plough to flatten the crop and cause it to bury easily. To hasten the decomposition of the material turned in the ploughed surface may be rolled flat.

Planting: The planting of fruit-trees should be completed with as little delay as possible. If the spring be a dry one trees planted very late will not make the same strong growth at the start as the earlier-planted trees.

Grafting: According to the locality and the season, grafting may be done from about the second week in September up till the second week in October. Scions should be secured while the tree is dormant, and should be kept in a cool place until ready for use. Better results are obtained when the stock is in advance of the scion in growth, as a quicker union is made when the sap is active in the stock. Grafting requires to be done when the sap is rising freely and when the bark lifts easily. The growing tissues of both stock and scion must be fitted closely together so that the sap may pass readily from the stock to the scion. Prepare the stocks by heading them back three weeks before grafting is to be done. Grafting methods are detailed in the *Journal* for September, 1916.

Spraying: This is the most important operation in securing clean fruit. If the orchardist has not already considered what his spraying programme is to be for the coming season he should do so without delay. If black or green aphis were present last season in stone-fruits spray the trees at bud-movement with red oil, 1–30. Those which were affected with leaf-curl, shot-hole fungus, or bladder-plum should be sprayed with bordeaux, 8–6–40, at bud-movement; followed by further applications at strength of 6–4–50, or with lime-sulphur, 1–30, at open cluster (pink); with lime-sulphur, 1–125, at fruit-set; and again two weeks later. For woolly aphis, mussel scale, and red mite, infected pip-fruit trees should be sprayed with red oil, 1–20, at bud-movement. Prepare the emulsion as recommended in last month's notes. For all fungus diseases bordeaux or lime-sulphur will be found to be the best spray to apply, commencing at bud-movement. The most important applications for the control of black-spot are made at the open-cluster period, just when the blossoms are showing pink; at the calyx period; and again two weeks after the latter. In the event of rains within two or three days of spraying, respray the trees.

Specimens: If there is any disease in your fruit-trees that you want to know more about, send in a specimen of it with a note describing its appearance and the extent of the damage. I will have it identified and will suggest a means for its control. —*W. K. Dallas, Orchard Instructor, Christchurch.*

OTAGO.

Stone-fruits at the first sign of swelling buds should be sprayed with bordeaux, 8–6–40, for prevention of leaf-curl, &c. Trees that suffered from attacks of green aphis last season, and have not already been sprayed with oil, 1–12, should receive an application of oil, 1–20, about one week after bordeaux has been applied. Where oil sprays have not yet been applied to pip-fruits, an application at 1–15 should be made at the first sign of bud-movement; this takes the place of mid-winter spraying. Although the writer prefers the oil sprays at 1–8 for pip-fruits and 1–12 for stone-fruits when the trees are quite dormant, as recommended in these notes last month, it is far better to spray later at the reduced strengths than to neglect spraying altogether.

Planting may be carried out now. Care should be taken to select the best stocks available in the shape of strong well-grown trees, yearling rods for preference. Trim the roots well back before planting, and remove all broken or bruised portions. Head back rods to about 15 in. high when planted. Two-year-old trees should be pruned hard back to about 3 in. or 4 in. on three well-selected evenly spaced branches. —*P. G. Goodwin, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE chief concern of the poultry-keeper at present should be to get every possible chicken hatched out before the end of September. If chickens are to thrive and return a maximum of profit they must be well over the brooder stage before the hot summer weather sets in. The production of late-hatched stock is the weak link on many unsuccessful plants. One cannot urge too strongly the importance of hatching the young birds out at the right season, and also of giving them the best of attention from first to last.

It may be advisable in this respect to point out to the novice that disaster is invited if he attempts experiments in the work of incubating the chicks or during the time they are going through the brooder stage. I have recently come in contact with a surprising number of beginners who practically refuse to adopt the most approved methods we have of working incubators and managing brooder chicks. In a recent case I saw one of the most modern makes of incubators turned into a death-trap merely because its owner, being under the impression that more ventilation was necessary, made the walls of the machine like a honeycomb with auger-holes. Again, in regard to fireless brooders, few beginners strictly adhere to the conditions laid down as to their working. For instance, where a single piece of blanket is recommended for the hover-frame it is not uncommon to find the beginner using from two to four pieces, and in one case I saw a piece of sheep-skin being used. Of course, in these cases the mortality was great, and it would have been surprising in the circumstances had it not been so. The novice will be well advised to choose as his authority one who has paid for his experience, and follow his advice to the letter—at any rate, until such time as he has gained sufficient experience to sift the chaff from the wheat for himself. Gaining experience in a small way and working up by degrees, or serving an apprenticeship under a competent man, are the only safe courses for those who contemplate poultry-farming as a sole means of livelihood. True, to experiment is one of the best means of gaining knowledge, but where the whole success or failure of a plant depends on the result of an experiment obviously it is one of the things the novice should avoid.

A CHICKEN TROUBLE.

It is not generally known that much of the mortality which takes place in chickens when from three to six weeks old is due to the yolk (which is drawn into the chicken's body just before it leaves the shell) failing to digest. In such cases the yolk, instead of being gradually absorbed to provide nourishment for the chick in the first few days, as nature intended, gets into a more or less hardened state, when death sooner or later takes place. Thus, when this condition is disclosed in a *post mortem* examination, the cause of death will be made apparent.

It is generally believed that failure of the yolk to digest is due to feeding the chicks too soon after hatching, or to overfeeding during the first week. It is also often considered that breeding from overfat hens is responsible. While all these factors may have some influence in regard to this undesirable condition, experience goes to show that it is due more to improper incubation than to any other cause. This is confirmed to a great extent by the fact that the trouble is seldom found in chickens that have been hatched by the natural mother. There it will be found that the yolk in its sac is in a more or less liquid state, which enables it to run freely and finally become absorbed. With incubator-hatched chicks the chief weakness probably lies in having the temperature too high during the whole or a part of the incubating-period, thus causing half-baking of the yolk and rendering it incapable of absorption. There are still many problems to be mastered in the work of artificial chick-production, and those who are disposed to investigate will find the trouble referred to an interesting one to follow up. In this connection it is always advisable to open up any chicken that dies, in order to discover, if possible, the cause of death.

REARING DAY-OLD CHICKS.

Some people who purchase day-old chicks and depend on the natural mother to rear them make the mistake of giving the hen charge of the young ones a day or two after her broody period has commenced. This invariably means that the

hen resumes laying in a short time, and ceases to properly mother the chicks before they are sufficiently old to look after themselves. Where a broody hen is being used for this purpose it will be found a wise course to allow her to sit on the nest for about a fortnight before giving her the care of the young ones. As a general rule, the longer a hen is allowed to remain broody on the nest the better will she mother the incubator-hatched chicks.

THE FUTURE BREEDING-COCKERELS.

It is an old saying, and undoubtedly a true one, that in breeding poultry the male bird is more than half the flock; yet there are few breeders who really know the correct ancestry of the male birds they are using. In this connection, the surest means of breeding male birds that will advance egg-laying power is to use a selected individual hen. Such a bird should be of outstanding quality, having not only a good laying-record, but also the necessary breed-requirements, constitutional vigour, desired size, and the production of good marketable eggs. If such a specimen is placed in a pen by itself, and has the presence of a striking male for, say, an hour each day, the cockerels produced (or at least the best of them) can be used for future breeding purposes with a great degree of certainty that desirable progeny will be produced. The ideal breeding-hen, even when her individual egg-record is not available, can be selected with a great degree of certainty by the man who understands his business, but in the case of a male bird selection is an entirely different matter. Thus the only safe course is to definitely know that the male to be used, in addition to possessing the other desired qualities, is the son of a heavy-producing mother. Having eggs from the special mating referred to, it is preferable that these be hatched and reared under a natural mother, in order that the young birds may enjoy the most favourable conditions possible for their welfare. Sound breeding is the first great essential in building up or maintaining a heavy-producing strain, but unless this is accompanied by good feeding and favourable environment the results will prove disappointing. The system of specially mating for the production of good breeding-cockerels, as compared to merely selecting them by chance, has much to commend it, and the breeder who adopts it from generation to generation will be well repaid for his trouble.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

FOOD-STORES AND FEEDING.

DURING the month of September vigilance must be exercised in the apiary. It is during this critical period that mistakes are frequently made which tend to wreck the honey crop for the season. The main factor, especially in districts where spring feed is short, is to have ample food in the hives to encourage brood-rearing. It is surprising how much honey is necessary for this purpose, and as experts estimate that 5 lb. of honey is required to make one frame of brood it will readily be understood that insufficient stores, at a period when the colony has to rear thousands of young bees, must amount to an almost fatal handicap.

In apiaries that are absolutely free from disease the stores may be equalized with safety, but in those where disease may be lurking it is not advisable to adopt such a method for fear of spreading the malady, which usually is readily transmissible by spores in the honey. In cases where the stores cannot be equalized, through an insufficiency or for other reasons, the weaker colonies and others requiring feeding may be given a mixture consisting of 1 part sugar dissolved in 2 parts water, in quantities sufficient for their needs. None but the best white sugar should be used, as the poorer grades start dysentery and other disorders. It is advisable to feed a little each evening, as this has the effect of stimulating the bees to greater effort by fostering the idea that a honey-flow is in progress.

SWARMING.

Should the essential conditions for brood-rearing be present, a normal colony should have from eight to ten combs of brood towards the end of September. Some colonies may exceed this quantity, while other less fortunate ones, through a poor queen or other causes, may have only three or four. However, as this brood

emerges the hives become densely populated, and if left alone will contract the desire to swarm. This may suit the requirements of the beekeeper when increase is desired, but otherwise steps must be taken to prevent the issue of swarms, for swarming means the division of the colony, and thus a great loss of bees which would otherwise be working in the fields gathering nectar.

The presence of drones in the hive is a remote factor in connection with swarming, and is illustrated to the beekeeper in the presence of queen-cells. In the far North these may be present as early as the end of this month, but in the South they usually do not appear until late September or early October. They may appear as late as January, hence constant vigilance must be exercised and control methods applied throughout this period.

Queen-cells are usually built along the lower edge of the combs, and are so constructed that the opening is directly downwards and at right angles to the worker and drone cells. They are conical in shape like an acorn and as large as a small thimble, which they very closely resemble. Sometimes "cell-cups," or partially built queen-cells, are constructed long before the colony desires to swarm, and these must not be confused with the queen-cells proper. The latter will be recognized by their finished appearance and the presence of an egg or a larva in the bottom, and several may be present at the one time. This means that a swarm may be expected to issue, if the weather is favourable, in eight or nine days from the time the eggs were laid in the cells. The old queen goes along with the first or prime swarm, and the colony is then queenless until the virgins emerge. Occasionally the first virgin to hatch kills the others, but if the remaining bees desire to swarm again these are protected by the guards and several after-swarms may issue, thus hopelessly weakening the parent colony in its struggle to survive the coming winter. If the novice desires increase one swarm is sufficient from any normal colony, and the next day the parent hive should be overhauled and all queen-cells cut out except one—the largest and best-shaped —which is left to produce the future mother of the population.

Should honey alone be desired swarming must be controlled altogether, and three prime factors must be observed in this connection. There should be a young queen in every colony, as these are less susceptible to the swarming impulse and are better able to hold the colony together. Secondly, the queen should not be cramped for egg-laying room, and if another super is necessary it should be added. The third point is to provide ventilation sufficient for the colony's requirements. In hot weather, if the bees cluster outside the hive in the evening, either a cramped state in the hive or lack of ventilation is indicated, and an examination of the interior the following morning will reveal the position. If necessary, place two wooden blocks between the brood-chamber and the bottom-board in front, thus giving a wider entrance.

HYGIENE.

Cleanliness should at all times be a feature in apiary-management: therefore keep the bottom-board scraped clean and the grass clipped short around the hives, thus allowing fresh air and sunlight to exert their beneficial influence without obstruction.

A close watch should always be kept on the brood, and any signs of disease kept strictly under observation until there is no doubt as to its presence. Colonies affected with foul-brood should be treated in accordance with methods prescribed in the Department's bulletin "Foul-brood in Bees."

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

THE VINEHOUSE.

THE buds on the vines will now have started into growth. The weaker shoots can be removed as soon as they appear, the two strongest shoots being kept until the bunches can be seen and a decision made as to which is to be retained, preference being given to the lateral that promises to produce the best bunch of grapes and form a vigorous spur for the following season. On the young vines the shoot retained should, whenever possible, be on the outside of the spur, as

the shoot on the inside has less room to develop, and when pruned back in the winter will form a spur lying close to the rod, which, besides being unsightly, forms a convenient nesting-place for mealy bugs and other pests. When the laterals have made two leaves above the lowest bunch and the second leaf is about the size of a shilling the points of the shoots should be pinched out, and the side growths stopped as soon as they have formed one leaf of the same size. The sublaterals should be removed entirely when the grapes begin to colour.

To ensure well-developed and well-coloured bunches of grapes, only one bunch should be left on each shoot. Some commercial growers leave two bunches on each shoot on vigorous well-fed vines, but this should not be attempted under ordinary circumstances, as overcropping one season means a failure the next, and sometimes the effect is felt for several seasons.

Great care should be taken in tying the shoots down to the wires, as they are easily broken. With gross-growing varieties, such as Gros Colman and Alicante, the wire to which the rod is attached may be set 6 in. lower than those for the laterals. The laterals will not then be so liable to be broken off when being tied down. Sometimes a refractory lateral can be brought into position quite easily by giving it a gentle twist.

Where mildew has been present during the past season flowers of sulphur should be applied with a bellows or by means of a small muslin bag attached to a stick, when the leaves are just full grown, again when the flowers are in full bloom, and finally three weeks after the second application. These three applications usually suffice to arrest the growth of mildew if all bottom ventilation is shut off and kept so for the remainder of the season.

THE VINEYARD.

A few hints on the planting-out of rooted graftings will be seasonable. The planting of young vines needs to be carefully and thoroughly executed to obtain the maximum results. Preparatory cultivation is essential. The land should be thoroughly and deeply subsoiled in the winter or spring preceding the planting, then ploughed and harrowed during the summer in order to pulverize the soil as much as possible. Such cultivation can be made profitable by growing a crop requiring intensive culture. If the soil lacks humus a cover-crop might be sown in early summer and ploughed under in late autumn, or, if stable manure is available, this should be applied in late autumn or early winter before planting. Stable manure applied in this manner gives far better results than commercial fertilizers.

Should the graftings be at all dry on arrival from the nursery plunge them into running water for a day, after which they will be ready to plant out. If it is not convenient to plant them at once they should be placed in a trench and earthed up with moist soil to within three or four buds of the top so as to prevent their drying, a moist condition both before and after planting being essential to the success of this operation. When heeled in in this manner they may be kept several weeks if necessary. For planting, the graftings should be prepared by cutting away all dead or injured roots and shortening the healthy roots to uniform lengths of from 3 in. to 4 in. The removal of small roots and fibres does no harm; fresh fibres grow out again and quickly form healthy roots. Any roots growing at the top nodes of the stock or from the union should be entirely suppressed. One shoot only should be left on the scion—that which is in the best position and possesses the strongest development. This should not be cut back. "It is absolutely necessary to let it remain as it is, especially if the planting-out takes place in autumn," says a leading authority, F. Richter, of Montpellier.

The rooted graftings, having been prepared as described above, are placed in a receptacle which will hold water—a kerosene-tin or bucket will answer the purpose. The holes should be dug so that the union of the stock and scion, when planted, will be about 2 in. above the level of the surrounding soil. The vines will strike root best in the freshly turned moist soil of newly dug earth. A little fine soil is thrown in the bottom of the hole and the roots of the vine spread out on it, the stem being held in line with the other vines of the row. It must be borne in mind that the vine will sink a little when the soil is pressed round the roots, so allowance must be made for this. About 4 in. of soil should then be thrown round the roots, being tramped down firmly as it is shovelled in. The hole is then filled in with fine soil without tramping, and a mound made covering the whole to a thickness of 4 in. of soil over the graft-joint. In the spring, when the top buds of the shoot swell and are on the point of bursting, the soil is drawn away and the shoot pruned back to the second or third bud. The soil is then replaced to the level of the section made.

The vineyard should now be kept in good tilth and free of weeds, and the vines, as they grow, tied to stakes to obviate damage from the wind and keep the canes out of the way of the cultivator. They should receive the same preventive treatment as adult vines against cryptogamic diseases. In the early summer the soil should be drawn away from the vines and any roots on the scion or suckers growing on the stock cut away. The soil is then replaced round the union and left until February, when it can be taken away and the joint exposed to the air so that the tissues may harden and be in a better condition to withstand the changes of weather. Before winter the land is ploughed towards the vines, and they can be manured for the first time, if necessary. No manure is necessary or advisable about the roots or in the hole when planting.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

ASPARAGUS: Planting should be finished within the next two or three weeks Where artificial manure is required for established beds it should be applied at once. There can be no doubt that stable manure is the best fertilizer for asparagus, the physical composition of this material being as beneficial as the fertilizing-elements it contains. With a good supply of this manure artificial fertilizers are not indispensable, but considerable improvement is effected by the use of nitrate of soda, and the addition of sulphate of potash will also pay. If a plantation is in good growing-condition 1 oz. per square yard of each of the latter will be sufficient. If growth has not been good double the amount of nitrate of soda. Where the soil is heavy ashes from a rubbish-fire are very beneficial. Asparagus is a seaside plant, and many people think that seaweed and sea-sand must be valuable. Seaweed as a manure has no advantage over stable manure, and sea-sand as a means of keeping a heavy soil open requires to be used with caution. If the sand is coarse there is sure to be a large proportion of distinctly visible pieces of shell, and such sand will probably ruin the plantation. When the heads are allowed to develop the heavy tops wave in the wind; this causes a movement at the base of the stems, forming a little basin on the soil-surface into which the sand silts, and the sharp particles cut the stems and kill them. Many years ago I myself lost a bed in this way.

Cabbages and mildew: Early crops should be making headway by now. Early cabbages command a ready sale and satisfactory prices; consequently a good many growers try this crop, but not always with success. Mildew (*Peronospora parasitica*) is found troublesome in some places, but this disease is amenable to treatment if such is commenced in its early stages. Bordeaux spray is the remedy. If treatment be delayed, or if the attack is very persistent, the measures taken will fail. The only thing that can be done in such cases is to pull up affected plants and destroy them, either by burning or by burying them deeply in the ground. The outbreak of the disease in the first place is due to climatic and soil conditions, but once it starts it will spread from plant to plant. Spraying is useful to prevent infection. A wet subsoil, a heavy soil that holds too much water, soil containing too much vegetable matter, such as drained swamp, and too much animal-manure or an overplus of fertilizers, are all contributory causes in an outbreak. Briefly stated, these conditions mean either faulty root-action or too soft a plant. Bearing in mind that this crop is growing during a period of short days and, in most places, frequent rain, the aim should be to counteract as far as possible the injurious effects that are likely to result from these conditions. An open situation should be chosen, and well-drained soil not containing too much humus. Refrain from applying stable or farmyard manure or any such material, because this absorbs and holds moisture, making the soil wet and cold. Use nitrogenous fertilizers very sparingly. Lime the soil unless this has been done within the past year or two, and if liming has only recently been done give sulphate of potash, about 1 cwt. per acre. If the plants have been successfully carried through till the latter half of August the most dangerous period should be passed, and the crop should be ready for first cutting about the third week in October If the assistance of further fertilizer is considered necessary after the first period a mixture of 4 parts superphosphate, 2 parts nitrate of soda, and 1 part sulphate of potash may be given, using about 2 oz. per square yard. The same remarks are applicable to cauliflowers.

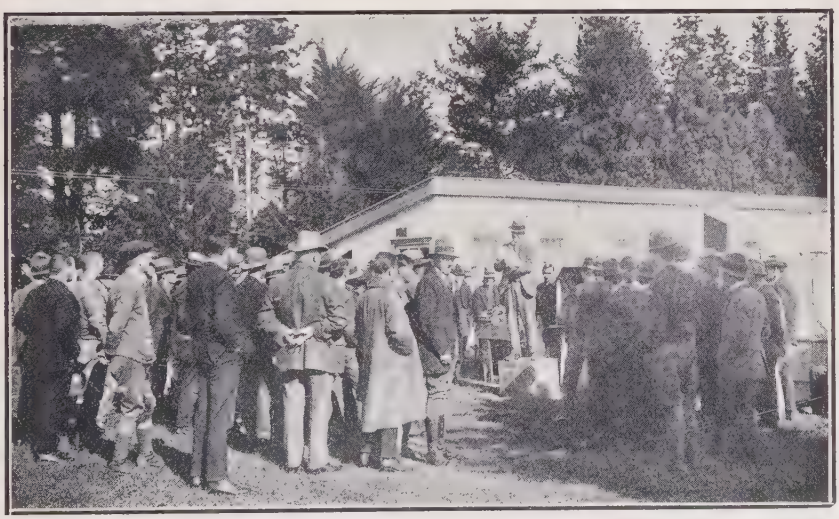
Celery: Seeds for early crops should be sown in boxes under glass. Do not sow too thickly, as crowded seedlings are very weak and difficult to handle. The seedlings should be pricked out in other boxes as soon as they can be handled. For main crops the seed can in most places be sown in the open ground, but this is not practicable where the climate is both hot and dry. In such places shade is necessary to conserve moisture, as the seed, being small, must be only just covered with soil. As a safeguard against rust disease sow seed that is at least two years old.

Leeks: Sow about 15th September and transplant early in January. They will then come into use by May and give a supply for about five months. A good many growers sow much earlier than the date mentioned, which is all right if there are special reasons for extending the period of use and a later sowing is also made. September is early enough, for it is as a true winter vegetable that the leek is most valuable.

Jerusalem artichokes: In the warmer districts artichokes will be started before this. In most places the tubers sprout during August. Plant medium-sized tubers 5 in. deep in rows 3 ft. apart, and with 15 in. between sets in the row. To secure good tubers there should not be more than two or three stems allowed, and for this reason large tubers are not planted. If more stems come than are wanted it is easy enough to tear out the surplus when they are about 1 ft. high.

Cauliflowers: During the second week in September sow an autumn giant variety. This is a very important sowing; the crop should come in just as peas and French beans are finished. If heads are wanted before then, but after those planted in spring, sow an early variety, such as Early Paris, Early London, or Snowball, at once.

Parsnips, carrots, and red beet may be sown at any time. The main supply should not be sown for about two months; if started too early the roots wanted for winter use become overgrown and coarse. Peas should be sown twice each month. French beans are in most places not sown till October, but in warm and frost-free places they may be sown earlier. Sow small breadths of turnips at intervals of from six to eight weeks. Lettuces should be sown frequently during summer. The best plan is to sow when the plants last set out have started into free growth. Radishes should be sown in small lots about every tenth day. Both the sowing and transplanting of onions should be done at once or the crops will not have time to develop. As stated previously, planting and sowing late is not desirable, but is unavoidable in some cases. Tomatoes for outside planting should be sown within the next week or so. Prick off the young plants as soon as they can be handled.



A DEMONSTRATION BY THE CHIEF POULTRY INSTRUCTOR, MR. F. C. BROWN, AT THE RECENT FARMERS' SCHOOL, RUAKURA.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MAKING GREEN-HIDE LEATHER.

J. A. WALLACE, Maungatautari :—

In connection with the recipe given in the May issue of the *Journal* (page 315) for making chrome leather, I should like to know how the hair may be removed from the hide to be cured; also what quantities of water are used per pound of chemical in the curing process.

The Live-stock Division :—

For removing the hair from a hide about to be cured, take 5½ lb. of roche-lime, add 10 gallons of water and 2 oz. of sulphite of soda, and mix well. Steep the hide in this mixture until the hair comes off. The quantity of water used per pound of chemical does not affect the curing process. The weights of the percentages prescribed vary according to the weight of the hide, and the chemicals are absorbed independent of the quantity of water used. A 50 lb. hide would take 2½ lb. of bichromate and 1¼ lb. of acid; and, again, 3¾ lb. of hypo-sulphite of soda and 1¾ lb. of sulphuric acid.

FEEDING OF PIGS.

W. B., Kakanui :—

Each season I have a considerable quantity of small potatoes, and have in the past boiled these with seconds and thirds of grain (wheat, oats, or barley) and fed to pigs. Do you recommend this course, or should the potatoes be fed raw? The grain generally passes through the pigs even when well boiled. Should it be ground before boiling?

The Instructor in Swine Husbandry :—

On account of a poisonous substance called solanine, which exists in potatoes in certain conditions, it is advisable always to boil or steam them; by doing so the feeding-value is also considerably increased. Grains should not be cooked with potatoes, but separately if specially required, as the grains take much longer to cook than roots, and if not properly cooked are not digested. It will be found more profitable to feed the grains in a dry state on a platform or clean trough. This has been proved to give the best results, as thorough mastication must take place under these conditions; otherwise, the grains could be fed in meal form, but this entails extra cost in grinding.

METHOD OF DESTROYING HAWTHORN HEDGES.

"HAWTHORN," Kaukapakapa :—

Will you please let me know the best, easiest, and cheapest way of destroying a hawthorn hedge. Is spraying effective? The hedges are mostly untrimmed, and are from 10 ft. to 18 ft. high.

The Horticulture Division :—

We know of no method of killing the trees by poison that would not involve as much labour as grubbing. In our opinion they cannot be readily killed by spraying. The cheapest method would be to trim off the lower branches, open up a good furrow with a heavy plough as close as possible to the boles of the trees, and then attach a chain to the trunks and haul them out with a team of horses. A man with an axe should stand by to cut large roots when necessary. If this plan cannot be carried out the only way will be to grub them by hand-labour With a sharp mattock and an axe the work can be fairly easily done.

MOLASSES AND STRAW CHAFF FOR STOCK.

EVANS BROS., Georgetown :—

We are now using straw chaff for horse-feeding, and have been informed that molasses can be advantageously used with this feed. Please advise as to this, and the correct quantity of molasses to use with, say, a kerosene-tinful of straw chaff.

The Live-stock Division :—

The addition of molasses to straw chaff will give very good results. It is advisable to commence with small doses, otherwise scouring will result. By gradually increasing the quantity horses and cattle may be given up to 2 lb. or 3 lb. per day. To commence with, dissolve 3 lb. of molasses in a kerosene-tinful of hot water, stir well, and use 1 quart of the mixture to a kerosene-tinful of chaff every night. This may be gradually increased by adding more molasses until 4 lb. to the kerosene-tinful of water is being given.

GROWING COCKSFOOT FOR SEED.

"INQUIRER" Hillgrove :—

Will you please tell me if it is a practical idea to grow cocksfoot for seed. If I sow cocksfoot and rape this coming season, about December, would I be able to get a crop of cocksfoot-seed the following season ?

The Fields Instruction Branch :—

It is quite a practicable idea to grow cocksfoot for seed. To get the best results the cocksfoot should be sown in early autumn at the rate of from 25 lb. to 30 lb. per acre. It should not be seeded until it is at least two years old. It is advantageous when sowing down a field with cocksfoot to include 2 lb. white clover per acre. To sow cocksfoot with rape in December would very likely mean a weak stand of cocksfoot, and the practice cannot be recommended.

SEAWEED AS A MANURE.

"INQUIRER," Sumner :—

Will you kindly advise me if seaweed is of any value as a fertilizer in growing potatoes and tomatoes, and, if so, how it should be applied ?

The Horticulture Division :—

Seaweed is comparable with stable manure, the composition of these two compounds as shown by analysis not being greatly different. Seaweed may be worked into the soil in a fresh state. Although analytic examination of seaweed and stable manure gives nearly the same result in each case, the latter is by far the more valuable manure, probably on account of the condition of its contents as regards humus. In old times seaweed was the sole manure used for potatoes in many parts of Ireland, and it is still largely used for that crop. It is more suitable for light than for heavy soil. There is danger that in good holding soil, and where there is a fair rainfall, certain diseases would be encouraged by its use ; this applies to both potatoes and tomatoes. Briefly stated, it may be quite safe for use in light or dry soil where there is but little rain, but dangerous under other conditions.

CONTROL OF FOXGLOVE.

C. A., Opatu :—

Could you tell me if foxglove is a noxious weed, and what harm would result from letting it grow ? I have about 100 acres of rough hilly ground on which foxglove has a good hold. I have cleared up logs and rubbish in places in order to give the stock a chance to crush the weed, but after a patch is burnt it seems to grow with increased vigour. Please advise as to the best means of eradication.

The Live-stock Division (Noxious Weeds Inspection) :—

Foxglove comes under the provisions of the Noxious Weeds Act in any district in which it has been declared a noxious weed by the local governing body. It is a menace, for the reason that on ground which is suited to it it will grow very dense and destroy the pasture. The only really effective method of destroying foxglove on land such as yours, which cannot be cultivated, is by hand-pulling the plants. If the area affected is too large to allow of this being done the best method is to cut the plants in order to prevent their further spread through seeding.

DEFICIENCY DISEASE IN CATTLE.

A. S., Waddington :—

Several of my cows have become quite stiff in the joints, and can only walk with great difficulty. I should be glad of advice as to the cause and treatment of the trouble.

The Live-stock Division :—

The description of the symptoms from which your cattle are suffering seems to point to a disease which affects cattle when there is a scarcity of available phosphates in the food. Some soils are deficient in available phosphates although the growth is luxuriant and the grass appears to be of the best, yet this grass does not supply the animal system with the necessary salts in an available form. The treatment recommended is to give Parrish's Chemical Food in doses of from two to four tablespoonfuls once daily in a drench, the Chemical Food being mixed with half a pint of gruel.

SORGHUM AS A FODDER FOR STOCK.

"Inquirer," Karaka :—

Can you give me any information as to what effect sorghum has on cattle or horses—especially milking-cows? I have been told that it has a weakening effect when fed to horses, even after it has flowered and seeded. Would it have a similar effect when made into ensilage?

The Live-stock Division :—

Sorghum is a useful fodder when fed to cows in conjunction with other foodstuffs. It should only be fed to stock in the ripe or flower stage, otherwise it may prove injurious. In the green stage, however, it can be made into ensilage, and fed with beneficial results. Second growths or sorghum that has been damaged by frost should not be fed to stock. This can, however, be made into ensilage. Sorghum is not a desirable food for horses, although a little can be given occasionally as an alternative.

HORSE BLEEDING FROM NOSE.

"Delta," Waipukurau :—

Could you kindly advise treatment for a draught horse which bleeds from the nose? One nostril bleeds fairly continuously, more especially when the animal is straining and pulling, and clotted blood appears when it attempts to get relief by snorting.

The Live-stock Division :—

Bleeding from the nose is not a very common condition in the horse. It occurs as the result of other troubles, such as an influenza cold and catarrh of the nasal passages, and when a nasal growth is present. An examination should be made, and if such a growth is present it should be removed by some reputable veterinarian. In your case I am inclined to think there is some weakness in the blood-vessels. The animal should not be put to work for some time. The nostril should be syringed out with 1 pint of cold water to which has been added ½ oz. each of nitrate of potash and chloride of ammonium. Afterwards a plug of wool should be inserted, and if the hæmorrhage continues 1 dram of acetate of lead should be given in a pint of water.

ABORTION DISEASE: THE UTERINE DOUCHE.

In the article on "Abortion Disease" published in the *Journal* last month permanganate of potash in 2-per-cent. solution was suggested as a uterine douche. Complaints have since been received of the staining character of such a solution, and in some cases its action has been found to be somewhat severe when used, apparently, on inflamed surfaces. It is not intended to endeavour to sterilize the womb by means of antiseptic injections—a practically impossible task—but rather, by irrigation, to mechanically remove the accumulated morbid products. A stock solution of 2-per-cent. permanganate of potash can be made up and kept in a stoppered bottle. Two ounces, or four tablespoonfuls, of the 2-per-cent. solution, added to 1 gallon of water which has been previously boiled and then allowed to cool to blood-heat, will prove suitable for the purpose referred to, and should be free from any objectionable properties. After a time the correct strength of the solution can be gauged by the colour. It should be a bright purple tint. The solution can be used for the irrigation of the genital passages of cows or bulls when necessary.—*H. A. Reid, Officer in Charge, Wallaceville Veterinary Laboratory.*

THE NEW ZEALAND WOOL COMMITTEE.

The New Zealand Wool Committee commenced its duties on 25th June, immediately after the gazetting of the Wool Industry Regulations, and has met almost daily in order to ensure the success of the measures and so that the operations may be carried out without any dislocation of trade. The wool-brokers, banks, and wool-exporters have given loyal support and have promptly signed the undertakings required by the Wool Committee that they will faithfully adhere to the regulations. The arrangements provide for furnishing the Customs Department with the names of all woolbrokers and wool-exporters who have given the necessary undertaking, and thereafter such exporters may ship wool without restriction. Also a certificate from a registered woolbroker that wool has been sold at prices not less than the minimum fixed reserve prices is accepted by the Customs for the free export of such wool which has been sold at the auction sales or privately.

The July series of sales (the first under the regulations) commenced in Wellington on 4th July, followed by Napier, Wanganui, Christchurch, Dunedin, Invercargill, and Timaru. The offerings have been fully equal to the buying-strength, and about 80 per cent. have been sold. The August series of sales commences at Wellington on 19th August.

It was decided that, pending the result of a conference with freezing companies, exporters of slipe wool should not be required to give the undertaking referred to, as slipe wool comes little, if at all, into competition with the greasy clip. The conference was duly held, and the freezing companies' representatives agreed to recommend their members to support the proposals made for freezer slipe wool, provided, of course, that the accumulated stocks of slipe held by "Bawra" were subject to the same restrictions.

The committee has been closely considering the other matters referred to it by the Minister of Agriculture, such as the possibilities of other markets and the disposal of the surplus wool which it will probably be necessary to carry over at the end of the season, and will make a report to the Minister in due course.

Live-stock Statistics.—Preliminary figures for the season 1920–21, issued by the Government Statistician, show the total number of cattle in New Zealand as 3,112,742; dairy cows (included), 993,473; horses, 333,743; and pigs, 342,227. These represent good increases in dairy cows and pigs and a decrease in horses. The complete return of sheep as at 30th April shows a Dominion total of 23,285,031—a decrease of 634,939 compared with last year. Further particulars will be published in next month's *Journal.*

IMPORTATION OF FERTILIZERS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th June, 1921, the name, quantity, and value of each kind, together with country of departure, being specified :—

Sulphate of Ammonia.—United States, 2,025 tons, £28,324.

Gypsum.—Australia, 155 tons, £619.

Nitrate of Soda.—Australia, 15 tons, £370.

Basic Slag.—United Kingdom, 775 tons, £4,359; Belgium, 11,070 tons, £69,828; France, 100 tons £946; United States, 500 tons, £2,320: total, 12,445 tons, £77,453.

Blood-and-bone.—Australia, 50 tons, £707.

Bonedust.—India, 1,075 tons, £12,772; Australia, 582 tons, £8,506: total 1,657 tons, £21,278.

Bonedust and Bone Char.—Australia, 206 tons, £1,389.

Guano.—New Caledonia, 1,694 tons, £3,495.

Rock Phosphate.—Nauru Island, 2,300 tons, £4,681; Makatea Island, 10,102 tons, £25,033: total, 12,402 tons, £29,714.

Superphosphate.—United Kingdom, £6; Australia, 76 tons, £585; Japan, 1,599 tons, £11,627: total, 1 675 tons, £12,218.

Kainit.—Belgium, 15 tons, £99; France, 15 tons, £152; Germany, 20 tons, £136: total, 50 tons, £387.

Sulphate of Potash.—Germany, 55 tons, £1,741.

Other Fertilizers.—United Kingdom, £16; United States, 1 ton, £22.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs gives the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

Erratum.—In the article on "The Feeding of Dairy Cows," on the first page of this issue of the *Journal*, "5 lb. cheese at 1s. per pound, 15s.," *should read* "15 lb. cheese at 1s. per pound, 15s."

Introduction of Horses, Asses, and Mules into Great Britain.—New regulations made by the British Minister of Agriculture governing the admission of horses, asses, and mules into Great Britain are published for general information in the *New Zealand Gazette* of 4th August. These regulations take the place of Chapter I of the regulations published in the *Gazette* of 18th December, 1913.

Land for Discharged Soldiers.—The property lately acquired from the Hon. E. Mitchelson and known as Motutara Settlement, situated near the Muriwai Beach, North Auckland Land District, is being opened for application in thirteen lots on 22nd August. This estate has long been known for its Romney Marsh stud sheep, and has been farmed for many years by Mr. Mitchelson, who has spared no pains or expense in bringing the estate into good order. The block, which is of about 3,100 acres, consists generally of better-class clay loam fronting the sea, and is six miles by good formed road from Waimauku Railway-station. It is suitable for mixed farming, or should make good dairying and sheep farms, while in some of the more suitable places small fruit-farms could be worked in conjunction with the main operations.